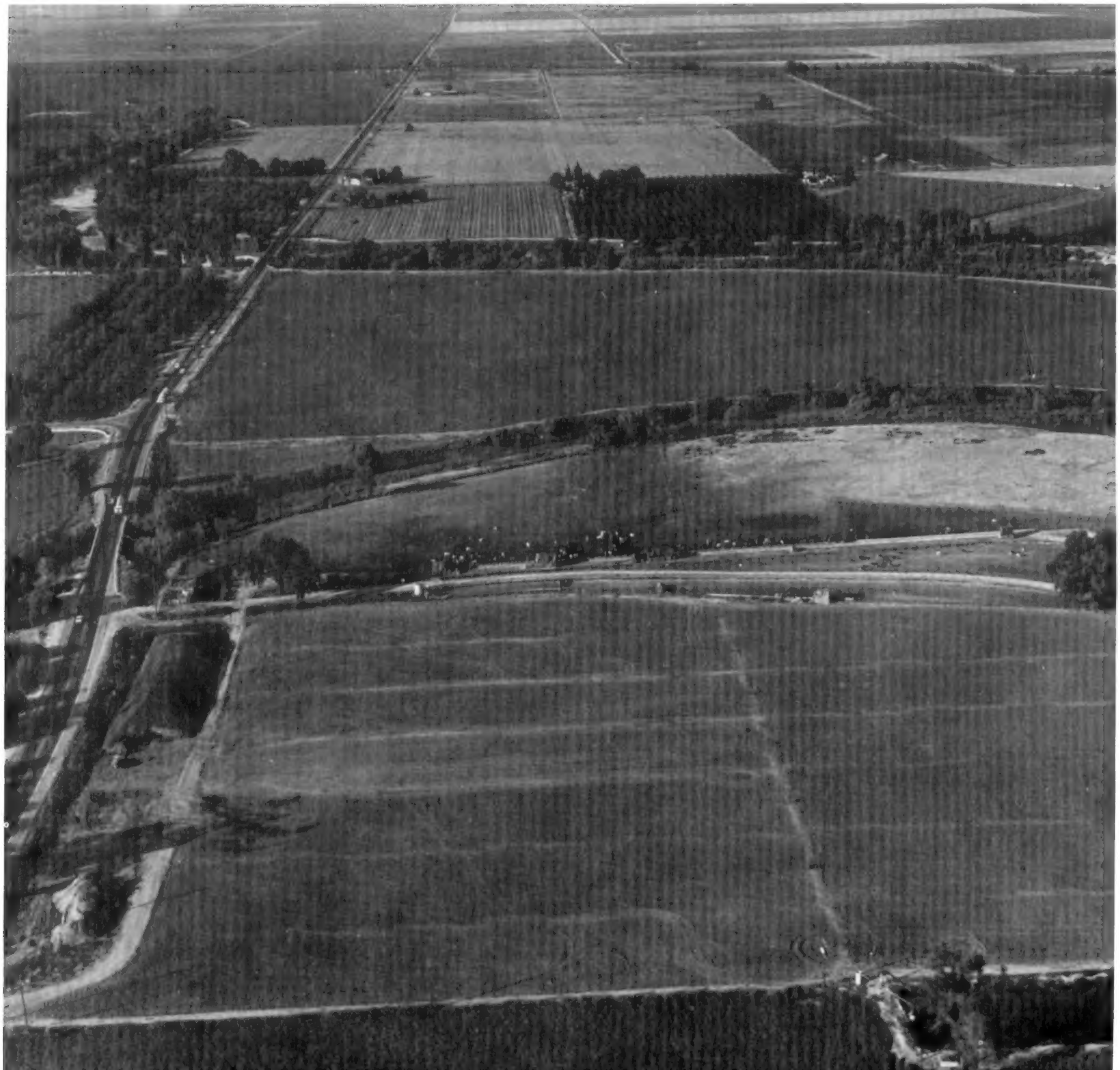
United States Department of Agriculture

Soil Conservation Service

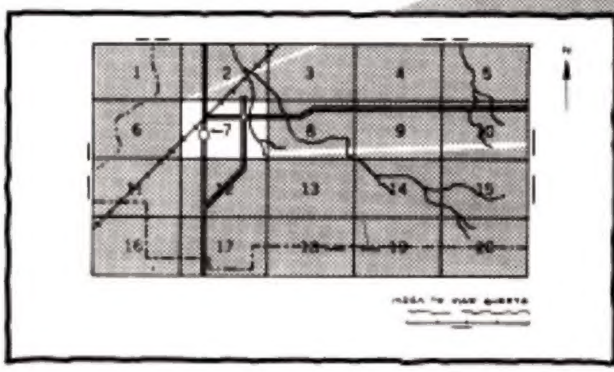
In cooperation with The Regents of the University of California, Agricultural Experiment Station

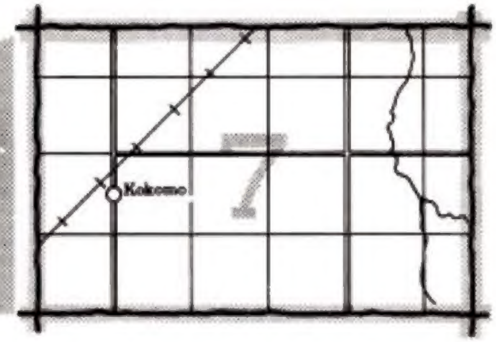
Soil Survey of Kings County California



HOW TO USE

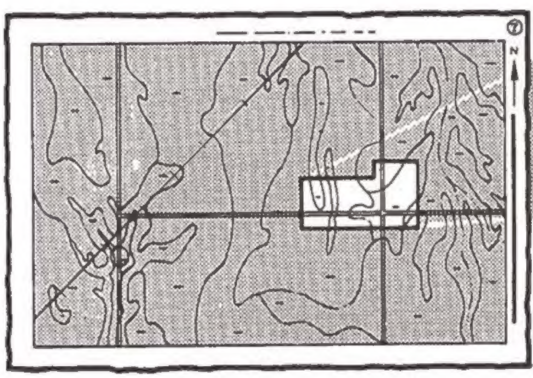
1. Locate your area of interest on the "Index to Map Sheets"

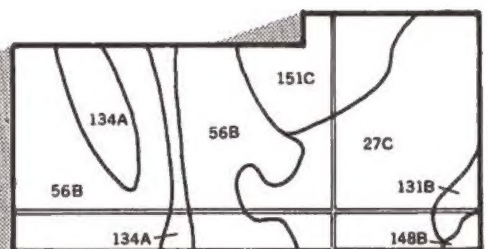




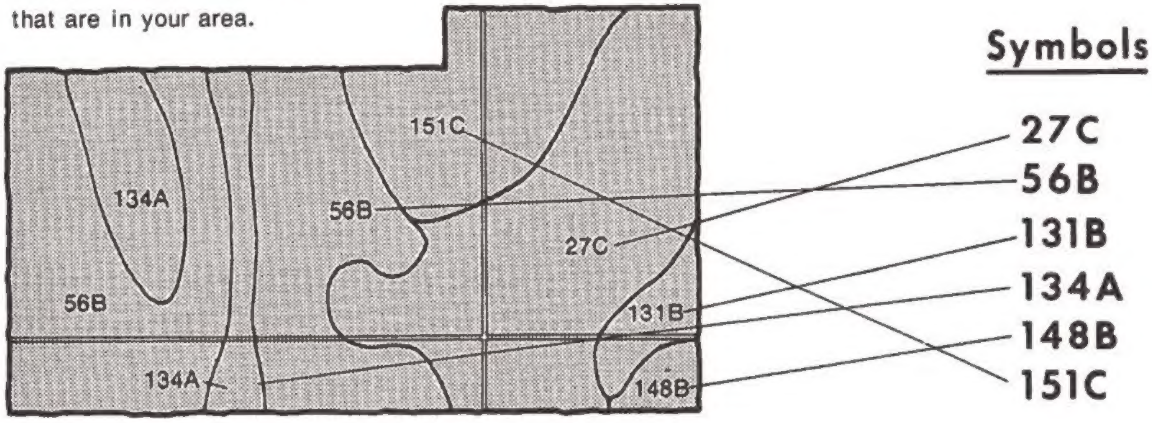
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



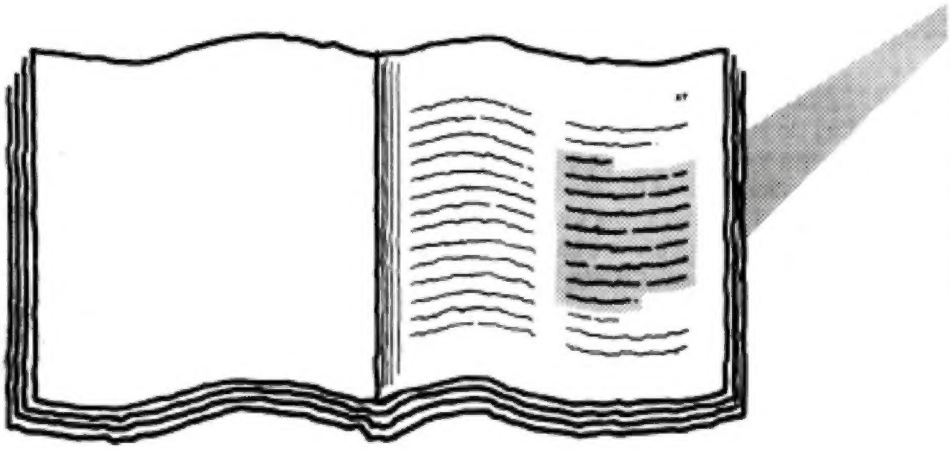


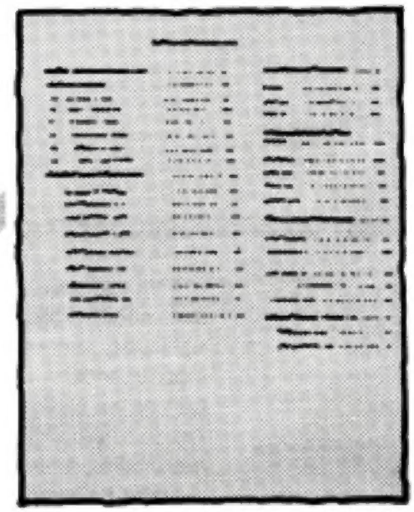
4. List the map unit symbols that are in your area.



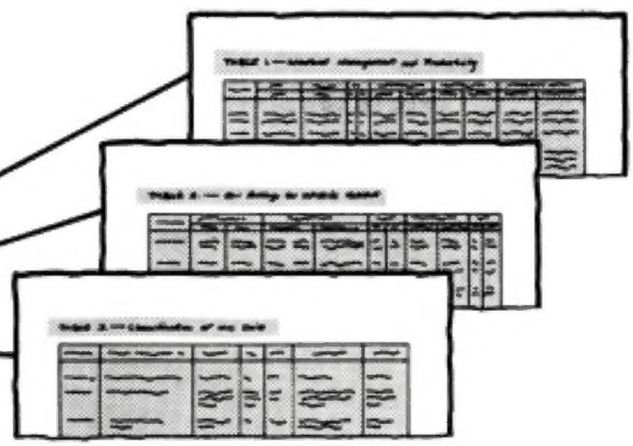
THIS SOIL SURVEY

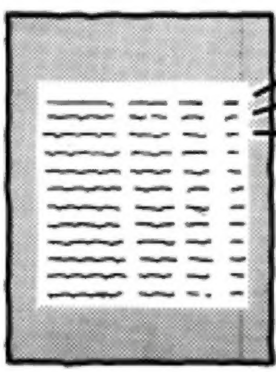
5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.





6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.





7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1979. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service and the Regents of the University of California, Agricultural Experiment Station. It is part of the technical assistance furnished to the Excelsior, Kings River, and Tulare Lake Resource Conservation Districts.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Area of Nord soils along the Kings River, in the northern part of the survey area. The area is used mainly for crops including walnuts, apricots, peaches, alfalfa, corn, and cotton and for dairies.

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Soil Series

Issued September 1986

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Kings County, California. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Eugene E. Andreuccetti
State Conservationist
Soil Conservation Service

Location of Kings County in California.

Soil Survey of Kings County, California

By Kerry D. Arroues and Carl H. Anderson, Jr.,
Soil Conservation Service

Fieldwork by Carl H. Anderson, Jr., Kerry D. Arroues,
Michael A. McElhiney, and Harold V. Burlingame,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
The Regents of the University of California,
Agricultural Experiment Station

KINGS COUNTY has an area of 892,800 acres, or about 1,395 square miles. The eastern boundary of the survey area is near the center of the San Joaquin Valley, and the southwestern corner extends into the Coast Range. The survey area is bounded on the east and north by Tulare County, on the south by Kern and San Luis Obispo Counties, on the west by Monterey and Fresno Counties, and on the north by Fresno County.

Most of the soils in the San Joaquin Valley are used for agriculture. Some areas are used for urban development. Most areas on the hills and mountains are used as rangeland. Elevation ranges from about 178 feet on the Tulare Lake bottom to about 3,473 feet on Table Mountain.

Four earlier soil surveys that include all or part of the county have been published. The oldest, which was one of the first soil surveys made in California by the United States Department of Agriculture, was the survey of the Hanford Area published in 1901 (*8*). Two reconnaissance surveys have been published—Middle San Joaquin Valley in 1916 (*7*) and Upper San Joaquin Valley in 1917 (*9*). A soil survey of Kings County was made in 1946 (*10*). The present survey updates all earlier surveys and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

This section provides general information about the survey area. It discusses history and development; physiography, relief, and drainage; natural vegetation; water supply; agriculture; and climate.

History and Development

The Gold Rush of 1849 was the main factor in bringing settlers to the San Joaquin Valley and to the area that is now Kings County. Raising cattle and sheep was the main agricultural enterprise at first, but soon wheat became the major agricultural product. Construction of the railroad provided more rapid transportation, and thus irrigated orchards and vineyards became profitable. With intensive agriculture development, Kings County began to assume prominence. The introduction of alfalfa in the latter part of the nineteenth century stimulated dairying and helped to diversify agriculture.

Kings County was established in 1893. The three largest towns in the county are Hanford, the county seat, and Lemoore and Corcoran. Other towns in the county

are Stratford, Armona, Hardwick, Avenal, and Kettleman City.

The discovery of oil in the Kettleman Hills added greatly to the importance and wealth of Kings County. The towns of Avenal and Kettleman City were formed as the result of this discovery. Drilling for oil began on these hills about 1907 (*3*); however, the wells were relatively shallow and oil-bearing strata were not reached. In 1928 the first major oil-producing well was brought under control.

According to the United States Bureau of Census, the population of Kings County was 35,168 in 1940. By 1960 the population reached 49,954, and by 1980 it was 73,738.

About 95 percent of the land in Kings County is under private ownership. The remaining acreage is administered by the city, county, or Federal government. The land administered by the federal government consists of that on Lemoore Naval Air Station and that administered by the Bureau of Land Management.

Electricity and natural gas are supplied to nearly all parts of the area. Bottled gas is available in the more isolated areas. Telephone service is supplied to most of the area, and television, shopping centers, and other modern conveniences are also available.

Recreation is readily available in Kings County. Rivers, ponds, and the California Aqueduct provide fishing. Several county and city parks are also available.

Throughout the county, interstate and state highways and secondary roads connect smaller communities and help to speed traffic to major centers. Truck lines and railroads provide shipping facilities and transportation.

Physiography, Relief, and Drainage

More than three-fourths of the survey area is in the San Joaquin Valley, and the rest is in the hills and mountains west of the San Joaquin Valley. The San Joaquin Valley forms the southern half of the central valley, which is enclosed on all sides by mountains, except where the Sacramento and San Joaquin Rivers enter the San Francisco Bay.

The soils in the part of the survey area that is in the San Joaquin Valley formed in alluvial material deposited as a result of runoff from the the Sierra Nevada, Kettleman Hills and other associated hills, and the Diablo Range. The drainage into the valley is mainly from the Sierra Nevada to the east.

The Kings River alluvial fan and flood plain in the northeastern part of the county were formed from the deposition of alluvial material from the Sierra Nevada. The large, nearly level Kings River alluvial fan consists of material deposited by the Kings River. Its vast surface is dissected and cut by shallow, meandering sloughs and creeks. Many of the sloughs have been filled and leveled and are now farmed. The highest point on the Kings River alluvial fan is about 295 feet. Hanford is at an elevation of about 250 feet.

The Kings River is a major source of water to the Tulare Lake. This was originally one of the largest lakes in California; it occupied the entire southeastern one-third of the county. Its approximate boundary was at an elevation of about 190 feet and its lowest point was at 178 feet.

Some of the other major sources of water to the Tulare Lake are the Tule River on the eastern side, the Kern River on the southern side, Cross Creek on the northeastern side, and Avenal Creek on the southwestern side. Other minor streams and creeks supply runoff to the Tulare Lake in winter but are dry in summer.

The Tulare Lake has been greatly restricted by dams and reservoirs in the Sierra Nevada, by levees, and by diversion of water for irrigation. In some recent years it has been dry; however, in most years part of the Tulare Lake Basin is flooded.

Several dams and reservoirs now regulate, to a certain extent, the flow of water into Kings County. Pine Flat Dam, constructed on the Kings River, impounds the waters of Pine Flat Reservoir. Wishon and Courtwright Reservoirs are also in the Kings River watershed. Success Dam, constructed on the Tule River, impounds the waters of Lake Success. Isabella Dam, constructed on the Kern River, impounds the waters of Isabella Lake. Terminus Dam, constructed on the Kaweah River, impounds the waters of Lake Kaweah and affects the flow of water in Cross Creek.

More than 30 percent of the irrigated soils in Kings County have a perched water table within 6 feet of the soil surface. This necessitates installation of some kind of artificial drainage system.

Ground water recharge occurs from percolation of water flowing in natural watercourses such as the Kings River, canals, sloughs, and sinking basins.

The alluvial fans on the western side of the San Joaquin Valley are nearly level to gently sloping. Dominant slope of these areas is toward the east. These fans formed in alluvial material from the Kettleman Hills and other associated hills.

The Kettleman Hills extend in a northwest-southeast direction and form the western edge of the San Joaquin Valley. They are dissected by many intermittent streams. The highest point in the Kettleman Hills is La Cima, which is at an elevation of 1,366 feet. The Kettleman Plain, a long narrow valley, separates the Kettleman Hills from the Kreyenhagen Hills, the low foothills at the base of the Diablo Range. Reef Ridge, an upturned sedimentary rock layer, forms the eastern side of the Diablo Range (fig. 1). The Diablo Range occupies the southwestern corner of the county. The highest point is 3,473 feet, on Table Mountain.

Figure 1.—Reef Ridge, a former horizontal sedimentary rock layer that was upturned, extends in a northwest-southeast direction and comprises part of the Rock outcrop-Lithic Torriorthents complex, 15 to 75 percent slopes.

Sunflower Valley is 6 miles east of the southwestern corner of the county. It formed in alluvial material from the Diablo Range and the hills west of the Kettleman Plain.

Natural Vegetation

Most of the valley areas are cultivated and support a wide variety of irrigated crops. Some natural vegetation remains in small unreclaimed areas of saline-alkali soils, particularly areas of soils that have a perched water table.

In the hills and mountains, the vegetation ranges from open areas of annual grasses to areas of dense shrubs and trees. During the dry period, in summer and early in fall, the hazard of fire in the hills and mountains is serious. Much of the native vegetation in the county has been replaced by introduced species or has been eliminated by cultivation and overgrazing.

The valleys originally supported large herds of elk, antelope, and wild horses that grazed mainly on native grasses. Even as early as 1844, filaree, an introduced forb from the Mediterranean region, was widespread and

well established (*15*). Marshes and sloughs occupying the valley floors support large areas of bulrushes or tules and cattails. Trees and shrubs including cottonwood, willow, wild rose, elderberry, California blackberry, and valley oak, are along many of the creeks and rivers.

The natural cover of the unreclaimed saline-alkali soils consists of stands of red brome, soft chess, foxtail barley, foxtail fescue, saltgrass, alkali blite, iodinebush, and saltbush.

Weeds are a serious problem in many cultivated areas. Bermudagrass provides good forage in irrigated pastures and makes a durable lawn, but it is a serious concern in fields of row crops and in vineyards. Other plants that cause problems are starthistle, nutsedge, sandbur, morningglory, puncturevine, Russian-thistle, mustard, fiddleneck, cocklebur, wild sunflower, and johnsongrass.

In the lower hills, where rainfall is low, the vegetation consists of annual grasses and forbs and a few shrubs. The main plants are red brome, foxtail fescue, filaree, and foxtail barley. Many forbs, including such wild flowers as California poppy, lupine, brodiaea, and owlclover are conspicuous in spring. On the higher hills and on mountains, where rainfall is higher, the vegetation is dominantly annual grasses, forbs, trees, and shrubs. The dominant grasses are wild oat and soft chess. Many forbs, including such wild flowers as California poppy, lupine, brodiaea, burclover, buttercup, and owlclover are conspicuous in spring. The principle trees in the wooded area are blue oak, Digger pine, juniper, and California scrub oak. Cottonwood, willow, elderberry, and tree tobacco grow along many streams. The shrubs consist mainly of chamise, ceanothus, California sagebrush, manzanita, California yerbasanta, black sage, and poison-oak.

Water Supply

Water of generally good to excellent quality is provided to the county by rivers, creeks, reservoirs, an aqueduct, and canals. The natural source is runoff from the accumulation of rainfall and snowfall in the Sierra Nevada. The water flows to the area mainly through the Kings and Tule Rivers, Cross Creek, and the California Aqueduct (fig. 2). The rivers supply much of the surface water used for irrigation and much of the ground water pumped for irrigation and for domestic and industrial use.

Figure 2.—Junction of Kings River with Blakeley and Tulare Lake Canals. Kings River empties into Tulare Lake, and the two canals border the approximate historic edge of it. Soils in this area are the somewhat poorly drained Boggs, Grangeville, Houser, Pitco, and Westcamp soils.

Some water is conveyed to the western part of the San Joaquin Valley through the California Aqueduct. Water is diverted from the aqueduct to irrigation districts. These districts distribute the water to farmers in the county.

The construction of Pine Flat, Success, Terminus, and Isabella Dams has helped to control flooding. The dams also help to regulate the use of surface water and ground water.

In the hills and mountains, water is obtained from seasonally intermittent streams, from springs, and from shallow wells in pockets of alluvium or highly weathered rock. Earthen dams have been constructed in drainageways throughout the hills and mountains to intercept and impound water for use by livestock and wildlife.

Agriculture

The combination of suitable soils, a plentiful supply of water for irrigation, and a long growing season have made possible the development of highly specialized, intensive farming in the survey area.

Much of the income in the area comes from crops. Field crops grown in the county include cotton, alfalfa, barley, wheat, safflower, corn, sorghum, irrigated pasture, sugar beets, soybeans, and rice. Alfalfa, wheat, and barley are also grown for seed production. Field crops are intermingled in places with fruit and nut crops.

Fruit and nut crops are grown on the Kings River alluvial fan and the upper alluvial fans on the western side of San Joaquin Valley. These crops include pistachios, peaches, grapes, almonds, walnuts, plums, nectarines, olives, and apricots.

Vegetable crops grown in the county include lettuce, tomatoes, cantalopes, onions, watermelons, cauliflower, broccoli, carrots, peppers, cabbage, squash, brussels sprouts, and string beans.

Nurseries in the county produce a wide variety of landscaping plants, deciduous trees, and grape vines.

Livestock, fish, and poultry raised in the county include cattle, turkeys, sheep, hogs, chickens, and catfish.

The dairy industry plays an important role in the county. The county ranks among the top ten counties in California in milk production.

Climate

By J.L. Hatfield, biometeorologist, University of California.

The survey area is characterized by a warm desert climate. Temperatures during the summer often exceed 100 degrees F, and temperatures rarely are less than 32 degrees. The growing season is long. Precipitation ranges from 6.2 to 8.1 inches in the part of the county in the San Joaquin Valley, and it ranges from 6.2 to 18 inches in the hills and mountains. Most of the precipitation is received in winter.

The climate of the area is typified by data from the Hanford and Kettleman weather stations.

Kettleman Station is in the southern part of the area, and Hanford Station is near the center of the valley. Temperatures for both locations are shown in table 1. Throughout the year the average temperature at Hanford varies from 45 degrees in January to 80 degrees in July; at Kettleman it varies from 47 degrees in January to 85 degrees in July. The typical diurnal range is 30 degrees throughout the year.

Soil temperatures have not been recorded in the area, but the soils are quite warm near the surface. Values for bare soil should be near or above air temperature for the 4-inch (10-centimeter) depth. The exact temperature depends on the soil cover and soil moisture content. Diurnal range of temperatures and the maximum and minimum values decrease with depth; the largest change can be expected in the upper 20 inches (50 centimeters) of the soil profile.

The differences between the northern and the southern ends of the county are best shown by the differences in the frost probabilities (table 2). Temperatures of 28 degrees are not recorded frequently enough at Kettleman to calculate the probability of occurrence above 50 percent.

The amount of precipitation received in the county is small (table 1). The largest amounts occur in January, and about 90 percent of the total rainfall is received between November and April. Rainfall is rare in summer, and it is usually associated with tropical storms.

The probability of receiving particular amounts of precipitation is shown in (table 3). Snowfall is rarely recorded in the county, and when it falls it is generally light and melts quickly.

Winds in the county are from a northerly direction, and they are generally less than 10 miles per hour.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology,

landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Soils on the Diablo Range

Two map units are in this group. They make up about 4 percent of the survey area.

The soils in this group are dominantly on the upper and middle positions on the landscape. Elevation ranges from about 1,250 feet near the Tent Hills to about 3,473 feet on Table Mountain, adjacent to Monterey County. Vegetation is dominantly annual grasses, forbs, shrubs, and trees. The average annual precipitation is 10 to 18 inches, and the average annual temperature is 59 to 62 degrees F. The average frost-free season is 200 to 240 days.

These soils are used mainly as rangeland, watershed, and wildlife habitat.

1. Henneke-Wadesprings-Millsholm

Shallow and moderately deep, moderately sloping to very steep, well drained soils that formed in residuum derived mainly from serpentine and sedimentary rock; on hills and mountains

This map unit is on Table Mountain, in the southwestern corner of the survey area.

This unit makes up about 1 percent of the survey area. It is about 33 percent Henneke soils, 31 percent Wadesprings soils, and 26 percent Millsholm soils. The remaining 10 percent is components of minor extent.

Henneke soils are shallow and well drained. They formed in residuum derived from serpentine. Slope ranges from 5 to 50 percent. Typically, the profile is very gravelly clay loam and very gravelly clay over serpentine at a depth of 18 inches.

Wadesprings soils are moderately deep and well drained. They formed in residuum derived from serpentine. Slope ranges from 15 to 75 percent. Typically, the profile is stony loam and cobbly clay loam over fractured serpentine, talc, and asbestos at a depth of 31 inches.

Millsholm soils are shallow and well drained. They formed in residuum derived from sandstone. Slope ranges from 15 to 75 percent. Typically the profile is clay loam over sandstone at a depth of 17 inches.

Of minor extent in this unit are moderately deep Vaquero soils that are clayey throughout, deep Altamont soils that are clayey throughout, and shallow Gaviota soils that are loamy throughout.

This unit is used mainly as rangeland, watershed, and wildlife habitat.

This unit is limited by the hazard of water erosion in the steeper areas. Slope limits access by livestock and results in overgrazing of the less sloping areas. The production of forage is limited on the Henneke and Millsholm soils by competition from brush and trees, by restricted rooting depth, and by restricted available water capacity. The Henneke soils are also limited by coarse rock fragments on the surface and an unfavorable calcium-to-magnesium ratio.

2. Gaviota-Vaquero-Altamont

Shallow to deep, moderately steep to very steep, well drained soils that formed in residuum derived from sedimentary rock; on hills and mountains

This map unit is on the eastern side of the Diablo Range, in the southwestern corner of the survey area.

This unit makes up about 3 percent of the survey area. It is about 31 percent Gaviota soils, 22 percent Vaquero soils, and 18 percent Altamont soils (fig. 3). The remaining 29 percent is components of minor extent.

Figure 3.—Abrupt transition from Vaquero and Altamont clays, 15 to 50 percent slopes, in grassy areas, to Gaviota-Rock outcrop complex, 50 to 75 percent slopes, in bushy areas.

Gaviota soils are shallow and well drained. They formed in residuum derived from shale. Slope ranges from 50 to 75 percent. Typically, the profile is loam over sandstone at a depth of 12 inches.

Vaquero soils are moderately deep and well drained. They formed in residuum derived from shale. Slope ranges from 15 to 75 percent. Typically, the profile is clay over shale at a depth of 36 inches.

Altamont soils are deep and well drained. They formed in residuum derived from sandstone. Slope ranges from 15 to 75 percent. Typically, the profile is clay over sandstone at a depth of 55 inches.

Of minor extent in this unit are deep Sagaser soils that are on north-facing side slopes and are loam and clay loam, Rock outcrop on ridgetops, deep Kreyenhagen soils that are loam and clay loam, shallow Millsholm soils that are clay loam, and very shallow Dystric Lithic Xerochrepts near shale outcropping.

This unit is used mainly as rangeland, watershed, and wildlife habitat.

This unit is limited by the hazard of water erosion in the steeper areas. Slope limits access by livestock and results in overgrazing of the less sloping areas. The production of forage is limited by landslides on the Vaquero and Altamont soils and by competition from shrubs, restricted rooting depth, and restricted available water capacity on the Gaviota soils. This unit is difficult to fence. Excessive shrinking and swelling of the Vaquero and Altamont soils cause fenceposts to be lifted out of the ground.

Soils mainly on the Kettleman and Kreyenhagen Hills

Three map units are in this group. They make up about 14 percent of the survey area.

The soils in this group are dominantly on the middle positions on the landscape. Elevation ranges from about

300 feet in the southeastern part of the Kettleman Hills to about 2,200 feet on Reef Ridge. Vegetation is dominantly annual grasses, forbs, and shrubs. The average annual precipitation is 5 to 7 inches, and the average annual temperature is 63 to 65 degrees F. The average annual frost-free season is 230 to 250 days.

These soils are used mainly as rangeland and wildlife habitat.

3. Delgado-Kettleman

Shallow and moderately deep, well drained and somewhat excessively drained, moderately sloping to steep soils that formed in residuum derived from sedimentary rock; on hills

This map unit is on Reef Ridge and on the Kreyenhagen, Pyramid, and Tent Hills, on the western side of the Kettleman Plains.

This unit makes up about 6 percent of the survey area. It is about 48 percent Delgado soils and 22 percent Kettleman soils. The remaining 30 percent is components of minor extent.

Delgado soils are shallow and somewhat excessively drained. They formed in residuum derived from sandstone. Slope ranges from 5 to 30 percent. Typically, the profile is sandy loam over hard sandstone at a depth of 10 inches.

Kettleman soils are moderately deep and well drained. They formed in residuum derived from sandstone or shale. Slope ranges from 5 to 50 percent. Typically, the profile is loam over sandstone at a depth of 39 inches.

Of minor extent in this unit are deep Reefridge soils that are clayey throughout, Rock outcrop on hilltops, very shallow Lithic Torriorthents near shale outcroppings, moderately deep Mercey soils that are loam and clay loam, moderately deep Parkfield Variant soils that have a gravelly clay loam surface layer and a clay subsoil, and very deep Panoche soils that are loam.

This unit is used mainly as wildlife habitat and for cattle and sheep grazing in winter and spring.

The production of forage on this unit is limited by low rainfall and the hazard of erosion. The Delgado soils are also limited by shallow depth to rock and restricted available water capacity.

4. Kettleman-Cantua-Mercey

Moderately deep and deep, moderately well drained and somewhat excessively drained, sloping to steep soils that formed in residuum derived from sedimentary rock; on hills

This map unit is on the Kettleman Hills. It is bordered on the west by the Kettleman Plains and on the east by the San Joaquin Valley.

This unit makes up about 7 percent of the survey area. It is about 42 percent Kettleman soils, 35 percent Cantua soils, and 18 percent Mercey soils. The remaining 5 percent is components of minor extent.

Kettleman soils are moderately deep and well drained. They formed in residuum derived from sandstone. Slope ranges from 5 to 50 percent. Typically, the profile is loam over sandstone at a depth of 39 inches.

Cantua soils are deep and somewhat excessively drained. They formed in residuum derived from sandstone. Slope ranges from 5 to 50 percent. Typically, the profile is coarse sandy loam over soft sandstone at a depth of 55 inches.

Mercey soils are moderately deep and well drained. They formed in residuum derived from sandstone. Slope ranges from 5 to 50 percent. Typically, the profile is loam and clay loam over sandstone at a depth of 25 inches.

Of minor extent are shallow Delgado soils that are sandy loam.

This unit is used mainly as wildlife habitat and for cattle and sheep grazing in winter and spring.

The production of forage is limited by low rainfall and the hazard of erosion.

5. Delgado-Carollo

Shallow and moderately deep, moderately sloping to moderately steep, well drained and somewhat excessively drained soils that formed in residuum derived from sedimentary rock; on hills

This map unit is on the southeastern side of the Kettleman Hills. It is bordered on the east by the San Joaquin Valley.

This unit makes up about 1 percent of the survey area. It is about 56 percent Delgado soils and 21 percent Carollo soils. The remaining 23 percent is components of minor extent.

Delgado soils are shallow and somewhat excessively drained. They formed in residuum derived from sedimentary rock. Slope ranges from 5 to 30 percent. Typically, the profile is sandy loam over hard sandstone at a depth of 10 inches.

Carollo soils are moderately deep and well drained. They formed in residuum derived from shale. Slope ranges from 5 to 20 percent. Typically, the profile is clay loam and clay over shale at a depth of 32 inches. It is saline-alkali throughout.

Of minor extent in this unit are deep Cantua soils that are coarse sandy loam, moderately deep Kettleman soils that are loam, and very deep Avenal soils that are loam and clay loam.

This unit is used mainly as wildlife habitat and for cattle and sheep grazing in winter and spring.

The production of forage on this unit is limited by low rainfall, the hazard of erosion, and restricted available water capacity. It is also limited by shallow depth to rock in the Delgado soil and saline-alkali condition of the Carollo soil.

Soils on alluvial fans on the western side of the San Joaquin Valley

Three map units are in this group. They make up about 10 percent of the survey area.

The soils in this group are dominantly on the lower and middle positions on the landscape. Elevation ranges from about 200 feet east of Kettleman City near the rim of Tulare Lake basin to about 1,000 feet in the northern part of Sunflower Valley. Vegetation is dominantly annual grasses and forbs. The average annual precipitation is 6 to 7 inches, and the average annual temperature is 63 to 65 degrees F. The average frost-free season is 240 to 275 days.

These soils are used mainly as rangeland, for irrigated crops, and as wildlife habitat.

6. Avenal-Panoche

Very deep, nearly level to gently sloping, well drained soils that have a loam surface layer and formed in alluvium derived from sedimentary rock

This map unit is in Sunflower Valley, near the southwestern corner of the survey area. Elevation ranges from about 650 to 1,000 feet.

This unit makes up about 1 percent of the survey area. It is about 56 percent Avenal soils and 35 percent Panoche soils. The remaining 9 percent is components of minor extent.

Avenal soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. Slope is 0 to 5 percent. Typically, the surface layer is loam and the subsoil and substratum are clay loam to a depth of 60 inches or more.

Panoche soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. Slope is 0 to 2 percent. Typically, the profile is loam to a depth of 60 inches or more.

Of minor extent in this unit are Twisselman soils that are silty clay and Kimberlina soils that are fine sandy loam over loamy fine sand at a depth of more than 40 inches.

The northern part of this unit is used mainly as wildlife habitat and for cattle and sheep grazing in winter and spring, and the southern part is used mainly for irrigated crops.

The production of forage is limited by low rainfall.

The soils in this unit are well suited to irrigated crops. The Avenal soils are limited mainly by the hazard of water erosion and moderately slow permeability; therefore, the application of water should be regulated so that water does not stand on the surface and damage the crops. The Panoche soils have no major limitations.

7. Panoche-Wasco

Very deep, nearly level to gently sloping, well drained soils that have a loam or sandy loam surface layer and formed in alluvium derived from sedimentary rock; on alluvial fans

This map unit is on the Kettleman plains. It is bordered on the east by the Kettleman Hills and on the west by the Kreyenhagen and Pyramid Hills. Elevation ranges from about 400 to 1,000 feet.

This unit makes up about 4 percent of the survey area. It is about 61 percent Panoche soils and 26 percent Wasco soils. The remaining 13 percent is components of minor extent.

Panoche soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. Slope is 0 to 2 percent. Typically, the profile is loam to a depth of 60 inches or more.

Wasco soils are very deep and well drained. They formed in alluvium derived dominantly from sandstone. Slope is 0 to 5 percent. Typically, the profile is sandy loam to a depth of 60 inches or more.

Of minor extent in this unit are gravel pits and gypsum quarries, Avenal soils that are loam and clay loam, Kimberlina soils that are fine sandy loam over loamy fine sand at a depth of more than 40 inches, Urban land, and Twisselman soils that are silty clay.

This unit is used mainly for irrigated crops (fig. 4).

The soils in this unit are well suited to irrigated crops. The Wasco soils are limited mainly by the hazard of erosion. The Panoche soils have no major limitations. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

8. Wasco-Panoche-Westhaven

Very deep, nearly level to gently sloping, well drained and moderately well drained soils that have a loam or sandy loam surface layer and formed in alluvium derived from sedimentary rock; on alluvial fans

This map unit is on the western side of the San Joaquin Valley. It is bordered on the west by the Kettleman Hills. Elevation ranges from about 200 to 700 feet.

This unit makes up about 5 percent of the survey area. It is about 30 percent Wasco soils, 28 percent Panoche soils, and 19 percent Westhaven soils. The remaining 23 percent is components of minor extent.

Wasco soils are very deep and well drained. They formed in alluvium derived mainly from sandstone. Slope is 0 to 5 percent. Typically, the profile is sandy loam to a depth of 60 inches or more.

Panoche soils are very deep and well drained. They formed in alluvium derived mainly from sedimentary rock. Slope is 0 to 2 percent. Typically, the profile is loam to a depth of 60 inches or more.

Westhaven soils are very deep and moderately well drained. They formed in alluvium derived mainly from sedimentary rock. Slope is 0 to 5 percent. Typically, the surface layer is loam and the underlying material is

Figure 4.—Typical area of Panoche and Wasco soils along the California Aqueduct, near Kettleman City.

stratified silt loam, silty clay loam, and silty clay. Loamy sand is below a depth of 84 inches.

Of minor extent in this unit are Milham soils that have a sandy loam surface layer, a sandy clay loam subsoil, and a loam and silty clay loam substratum; Kimberlina soils that are fine sandy loam over loamy fine sand at a depth of more than 40 inches; and Twisselman soils that are silty clay.

This unit is used mainly for irrigated crops.

The soils in this unit are well suited to irrigated crops. The Wasco and Westhaven soils are limited mainly by the hazard of erosion. The Westhaven soils are also limited by a stratified profile that restricts permeability and drainage. The Panoche soils have no major limitations. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Saline-alkali soils on lower alluvial fans and basin rims in the San Joaquin Valley

Three map units are in this group. They make up about 11 percent of the survey area.

The soils in this group are dominantly on the lower positions on the landscape. Elevation ranges from about 190 feet near the rim of Tulare Lake basin to about 500 feet in the Sunflower Valley. Vegetation in uncultivated areas is dominantly annual grasses and forbs. The average annual precipitation is 6 to 8 inches, and the average annual temperature is 62 to 65 degrees F. The average frost-free season is 250 to 275 days.

These soils are used mainly for irrigated row and field crops.

9. Lethent

Very deep, nearly level, moderately well drained soils that have a clay loam surface layer and formed in alluvium derived from sedimentary rock; on lower alluvial fans and basin rims

This map unit is dominantly made up of Lemoore Naval Air Station, west of the Kings River and the rim of Tulare Lake basin. Part of the unit is also in Sunflower Valley.

This unit makes up about 7 percent of the survey area. It is about 73 percent Lethent soils. The remaining 27 percent is components of minor extent.

Lethent soils are very deep and moderately well drained. They formed in alluvium derived from sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is clay loam, the subsoil is clay and clay loam, and the substratum is sandy loam.

Of minor extent in this unit are Panoche soils that are clay loam; Westhaven soils that have a clay loam surface layer and stratified clay, silty clay loam, and fine sandy loam underlying material; Urban land, dominantly airstrips on Lemoore Naval Air Station; and Twisselman soils that are silty clay.

This unit is used mainly for irrigated row and field crops.

Lethent soils are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. They are also limited by very slow permeability; therefore, the application of water should be regulated so that water does not stand on the surface and damage the crops.

10. Lethent-Garces-Panoche

Very deep, nearly level, well drained and moderately well drained soils that have a loam or clay loam surface layer and formed in alluvium derived from sedimentary and igneous rock; on lower alluvial fans and basin rims

This map unit is on the western side of the San Joaquin Valley, in the southern part of the survey area.

This unit makes up about 2 percent of the survey area. It is about 28 percent Lethent soils, 28 percent Garces soils, and 28 percent Panoche soils. The remaining 16 percent is components of minor extent.

Lethent soils are very deep and moderately well drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is clay loam, the subsoil is clay and clay loam, and the substratum is sandy loam.

Garces soils are very deep and well drained. They formed in alluvium derived from granitic rock. Slope is 0 to 2 percent. Typically, the surface layer is loam, the subsoil is clay loam and sandy clay loam, and the substratum is stratified coarse sandy loam to clay loam.

Panoche soils are very deep and well drained. They formed in alluvium derived from sedimentary rock. Slope is 0 to 1 percent. Typically, the profile is clay loam to a depth of 60 inches or more.

Of minor extent in this unit are Westhaven soils that have a clay loam surface layer and stratified clay, silty clay loam, and fine sandy loam underlying material, and Twisselman soils that are silty clay.

This unit is used mainly for irrigated row and field crops.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. The Lethent and Garces soils are also limited by very slow permeability; therefore, the application of water should be regulated so that water does not stand on the surface and damage the crops.

11. Lethent-Excelsior

Very deep, nearly level, well drained and moderately drained soils that have a fine sandy loam or sandy loam surface layer and formed in alluvium derived from igneous and sedimentary rock; on lower alluvial fans and basin rims

This map unit is near the southeastern part of the rim of Tulare Lake basin, in the extreme southeastern part of the survey area.

This unit makes up about 2 percent of the survey area. It is about 31 percent Lethent soils and 26 percent Excelsior soils. The remaining 43 percent is components of minor extent.

Lethent soils are very deep and moderately well drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is fine sandy loam, the subsoil is clay, and the substratum is loam and clay loam.

Excelsior soils are very deep and well drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is sandy loam and the underlying material is stratified loamy sand to silt loam.

Of minor extent in this unit are Westhaven soils that have a clay loam surface layer and stratified clay, silty clay loam, and fine sandy loam underlying material; Twisselman soils that are silty clay; evaporation ponds; Sandridge soils that are loamy fine sand; and Garces soils that have a fine sandy loam and loam surface layer, a clay loam and sandy clay loam subsoil, and a stratified coarse sandy loam to sandy clay loam substratum.

This unit is used mainly for irrigated row and field crops.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. The soils are also limited by restricted permeability. The application of water should be regulated so that water does not stand on the surface and damage the crops.

Saline-alkali soils that have a perched water table and are in basins and on low alluvial fans, alluvial plains, flood plains, and basin rims

Three map units are in this group. They make up about 39 percent of the survey area.

The soils in this group are dominantly on the lower positions on the landscape. Elevation ranges from about

178 feet in the Tulare Lake basin to about 235 feet near Dudley Ridge. Vegetation in uncultivated areas is dominantly annual grasses, forbs, and shrubs. The average annual precipitation is 6 to 8 inches, the average annual temperature is 63 to 65 degrees F. The average frost-free season is 250 to 275 days.

These soils are used mainly for irrigated row and field crops.

12. Gepford-Westcamp-Houser

Very deep, nearly level, somewhat poorly drained and poorly drained soils that formed in alluvium derived from igneous and sedimentary rock; in basins and on flood plains and basin rims

This map unit is on the western, eastern, and southern parts of the Tulare Lake.

This unit makes up about 15 percent of the survey area. It is about 38 percent Gepford soils, 22 percent Westcamp soils, and 22 percent Houser soils. The remaining 18 percent is of minor extent.

Gepford soils are very deep and poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the profile is clay with a clay loam or sandy substratum. A perched water table is at a depth of 2.5 to 4 feet.

Westcamp soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 2 percent. Typically, the surface layer is loam and silt loam. The underlying material is stratified silt loam to clay. A perched water table is at a depth of 4 to 6 feet.

Houser soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is clay or fine sandy loam. The underlying material is clay or silty clay and has thin strata of silt loam. A perched water table is at a depth of 4 to 6 feet.

Of minor extent in this unit are Rambla soils that have a loamy sand surface layer and loamy fine sand, clay, and loamy sand underlying material; Homeland soils that have a fine sandy loam surface layer and stratified loamy sand to very fine sandy loam underlying material; Sandridge soils that are loamy fine sand; Lakeside soils that have a loam and fine sandy loam surface layer and stratified loam and clay loam underlying material; evaporation ponds; Armona soils that have a loam surface layer and stratified sand to clay loam underlying material; Grangeville soils that have a sandy loam and loam surface layer and stratified sandy loam to very fine sandy loam underlying material; and Boggs soils that have a sandy surface layer and sandy loam and fine sandy loam underlying material that has thin strata of clay loam.

This unit is used mainly for irrigated row and fields crops.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. The soils are also limited by a perched water table, very long periods of flooding, and very slow permeability. It is difficult to leach the salts from the soil profile unless tile drainage is used to lower the water table. The application of water should be regulated so that water does not stand on the surface and damage the crops.

13. Tulare

Very deep, nearly level, somewhat poorly drained soils that formed in alluvium derived from igneous and sedimentary rock; in the Tulare Lake basin

This map unit is in the Tulare Lake basin, near the middle of the survey area.

This unit makes up about 13 percent of the survey area. It is about 99 percent Tulare soils.

Tulare soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the profile is clay throughout. A perched water table is at a depth of 4 to 6 feet.

Of minor extent in this unit are areas of water, primarily the Kings and Tule Rivers.

This unit is used mainly for irrigated row and fields crops.

Tulare soils are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant crops. They are also limited by a perched water table, very long periods of flooding, and very slow permeability. It is difficult to leach the salts from the soil unless tile drainage is used to lower the water table. The application of water should be regulated so that water does not stand on the surface and damage the crops.

14. Armona-Lakeside-Grangeville

Very deep, nearly level, somewhat poorly drained and poorly drained soils that formed in alluvium derived dominantly from igneous and sedimentary rock; on basin rims, flood plains, alluvial plains, and alluvial fans

This map unit is in the northern and northeastern parts of Tulare Lake and along the lower part of the Kings River.

This unit makes up about 11 percent of the survey area. It is about 30 percent Armona soils, 12 percent Lakeside soils, and 11 percent Grangeville soils. The remaining 47 percent is components of minor extent.

Armona soils are very deep and poorly drained. They formed in alluvium derived from igneous rock. Slope is 0 to 1 percent. Typically, the surface layer is loam. The underlying material is stratified sand and clay loam. A perched water table is at a depth of 2.0 to 4.5 feet.

Lakeside soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically,

the surface layer is loam and fine sandy loam. The underlying material is stratified loam and clay loam. A perched water table is at a depth of 4 to 6 feet.

Grangeville soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous rock. Slope is 0 to 1 percent. Typically, the surface layer is sandy loam and loam. The underlying material is stratified sandy loam to very fine sandy loam. A perched water table is at a depth of 3 to 4 feet.

Of minor extent in this unit are Vanguard soils that have a sandy loam surface layer and stratified fine sandy loam to sandy clay loam underlying material; Gepford and Pitco soils that have a clay surface layer and clay and clay loam underlying material; Lemoore soils that are sandy loam; Westcamp soils that have a loam or silt loam surface layer and stratified silt loam to clay underlying material; areas of water, primarily the Kings River, evaporation ponds, and reservoirs; Boggs soils that have a sandy loam surface layer and sandy loam and fine sandy loam underlying material that has thin strata of clay loam; Urban land; Goldberg soils that have a loam surface layer, a clay loam and clay subsoil, and a clay loam and sandy clay loam substratum; Homeland soils that have a fine sandy loam surface layer and stratified loamy sand to very fine sandy loam underlying material; Nord soils that have a fine sandy loam surface layer and stratified fine sandy loam and very fine sandy loam underlying material; and Tulare Variant soils that have a clay surface layer over clay and fine sandy loam underlying material.

This unit is used mainly for irrigated row and field crops.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. They are also limited by a perched water table and a stratified profile. It is difficult to leach the salts from the profile unless tile drainage is used to lower the water table. The stratified profile restricts permeability and drainage.

Soils on alluvial fans and flood plains in the middle of San Joaquin Valley

Three map unit are in this group. They make up about 22 percent of the survey are.

The soils in this group are dominantly on the middle positions on the landscape. Elevation ranges from about 200 feet near the Fresno Slough to about 300 feet in the northeastern corner of the survey area. Vegetation in uncultivated areas is dominantly annual grasses, forbs, and shrubs. The average annual precipitation is 7 to 9 inches, and the average annual temperature is 61 to 63 degrees F. The average frost-free season is 250 to 275 days.

These soils are used mainly for irrigated crops and pastures.

15. Nord

Very deep, nearly level, well drained soils that formed in alluvium derived from igneous and sedimentary rock; on alluvial fans

This map unit is in the northeastern and northern parts of the survey area.

This unit makes up about 10 percent of the survey area. It is about 62 percent Nord soils. The remaining 38 percent is components of minor extent.

Nord soils are very deep and well drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is fine sandy loam. The underlying material is stratified fine sandy loam and very fine sandy loam. About 30 percent of the areas of the Nord soils are saline-alkali.

Of minor extent in this unit are Grangeville soils that have a fine sandy loam surface layer and stratified sandy loam and fine sandy loam underlying material; Kimberlina soils that are fine sandy loam over loamy fine sand at a depth of more than 40 inches; Urban land; Wasco soils that are sandy loam; Whitewolf soils that have a coarse sandy loam surface layer over sand underlying material; areas of water, primarily the Kings River; and Cajon soils that have a sandy loam surface layer over loamy sand and sand underlying material.

This unit is used mainly for irrigated row and field crops and for fruits and nuts. Some areas are used for urban development.

The main limitations for urban development are the saline-alkali areas, which are highly corrosive to steel and concrete, and moderately slow permeability, which can cause septic tank absorption fields to fail.

16. Kimberlina-Garces

Very deep, nearly level, well drained, saline-alkali soils that formed in alluvium derived dominantly from igneous and sedimentary rock; on alluvial fans

This map unit is dominantly in the eastern part of the survey area.

This unit makes up about 11 percent of the survey area. It is about 45 percent Kimberlina soils and 12 percent Garces soils. The remaining 43 percent is components of minor extent.

Kimberlina soils are very deep and well drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 2 percent. Typically, the profile is fine sandy loam to a depth of 60 inches or more.

Garces soils are very deep and well drained. They formed in alluvium derived from granitic rock. Slope is 0 to 2 percent. Typically, the surface layer is loam, the subsoil is clay loam and sandy clay loam, and the substratum is stratified coarse sandy loam to sandy clay loam.

Of minor extent in this unit are Lakeside soils that have a clay loam surface layer and stratified sandy loam

to clay loam underlying material; Nord soils that have a fine sandy loam surface layer and stratified fine sandy loam and very fine sandy loam underlying material; Goldberg soils that have a loam and clay loam surface layer, a clay and clay loam subsoil, and a clay loam and sandy clay loam substratum; areas of water, primarily reservoirs and evaporation ponds; Excelsior soils that have a sandy loam surface layer and stratified loamy sand to silt loam underlying material; Corona soils that have a silt loam surface layer and a silty clay loam and loam subsoil over a sandy loam substratum; Grangeville soils that have a fine sandy loam surface layer and stratified sandy loam and fine sandy loam underlying material; Wasco soils that have a sandy loam profile; Westhaven soils that have a loam surface layer, stratified underlying material of silt loam to silty clay, and loamy sand and sand underlying material.

This unit is used mainly for irrigated crops and pasture.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. The Garces soils are also limited by very slow permeability. The application of water should be regulated so that water does not stand on the surface and damage the crops.

17. Remnoy-Melga-Youd

Shallow and very deep, nearly level, somewhat poorly drained, saline-alkali soils that formed in alluvium derived from igneous and sedimentary rock; on flood plains and alluvial fans

This map unit is near Cross Creek, in the northeastern part of the survey area (fig. 5).

This unit makes up about 1 percent of the survey area. It is about 38 percent Remnoy soils, 23 percent Melga soils, and 23 percent Youd soils. The remaining 16 percent is components of minor extent.

Remnoy soils are shallow and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 2 percent. Typically, the surface layer is very fine sandy loam and the subsoil

Figure 5.—Area of Melga and Youd soils along Cross Creek.

is clay loam. The next layer is a hardpan that is cemented with lime and silica. Below this is stratified silt loam and sandy loam.

Melga soils are very deep and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 2 percent. Typically, the surface layer is loam and silt loam and the subsoil is silty clay loam and clay loam. The next layer is clay loam that is weakly cemented with lime and silica. Below this are strata of fine sandy loam, very fine sandy loam, and silt loam.

Youd soils are shallow and somewhat poorly drained. They formed in alluvium derived from igneous and sedimentary rock. Slope is 0 to 1 percent. Typically, the surface layer is fine sandy loam underlain by a hardpan. The underlying material is very fine sandy loam and sand.

Of minor extent in this unit are Kimberlina soils that are fine sandy loam, Excelsior soils that have a sandy loam surface layer and stratified loamy sand to silt loam underlying material, and Wasco soils that are sandy loam.

This unit is used mainly for irrigated crops and pastures.

The soils in this unit are saline-alkali; therefore, they are best suited to salt- and alkali-tolerant, drought-resistant crops. They are also limited by brief periods of flooding and very slow or slow permeability. The application of water should be regulated so that water does not stand on the surface and damage the crops. The cemented layers can be ripped and shattered to increase the effective rooting depth and improve internal drainage.

Detailed Soil Map Units

The map units delineated on the detailed maps with this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils and miscellaneous areas have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed. The smallest area delineated on the soil maps is about 5 acres in highly contrasting areas and about 15 acres in less contrasting areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Westhaven loam, 0 to 2 percent slopes, is one of several phases in the Westhaven series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Kettleman-Cantua complex, 30 to 50 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar

interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Vaquero and Altamont clays, 15 to 50 percent slopes, is an undifferentiated group in this survey area. An undifferentiated group is recognized by use of the word "and" between the components in the map unit name.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits and dumps is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

101—Armona loam, partially drained. This very deep, poorly drained, saline-alkali soil is on basin rims and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 190 to 250 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is dark gray and gray loam about 14 inches thick. The upper 11 inches of the next layer is gray and light gray loam and sandy loam, and the lower part to a depth of 30 inches is gray clay loam. Below this, to a depth of 36 inches, is a buried surface layer of olive gray loam. The upper 5 inches of the underlying material is olive gray silt loam, and the lower part to a depth of 60 inches or more is light gray sand. In some areas the surface layer is sandy loam or clay loam. Mottles are in all layers below a depth of 9 inches. The soil is calcareous between depths of 9 and 41 inches and is saline-alkali throughout.

Included in this unit are small areas of Boggs sandy loam, Homeland fine sandy loam, and Vanguard sandy loam that have been partially drained. Also included are small areas of soils, on the Tulare Lake basin rim and the Kings River flood plain, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Armona soil is moderately slow. Available water capacity is very low to moderate because the salinity of the soil varies from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 2.0 to 4.5 feet. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, the use of tile and interceptor drains, and filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

Most areas of this unit are used for irrigated crops, mainly barley and cotton. A few areas are used for hay and pasture and for urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, and the stratified profile. Tile drainage can be used if a suitable outlet is available. The amount of salts present, the type of stratification, the crop planted, and the reclamation procedures used affect the yields of crops on this unit.

If this unit is used for irrigated crops, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid can be used to reclaim the soil in this unit. Lime should be present in the surface layer if sulfur or sulfuric acid is added.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and wetness. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching the salts from the surface layer is limited by wetness. Salt-tolerant species are most suitable for planting. Gypsum, sulfur, and sulfuric acid can be used to reclaim the soil. Lime should be present in the surface layer if sulfur or sulfuric acid is added.

Proper drainage and irrigation water management reduce the concentration of salts. Irrigation water can be applied by the border and sprinkler methods.

If this unit is used for urban development, the main limitations are wetness and the saline-alkali condition of the soil.

Wetness causes septic tank absorption fields to fail. Deep drainage reduces the problem of wetness. Tile drains can be used if a suitable outlet is available.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used.

Landscaping plants that tolerate wetness and droughtiness should be selected if irrigation and drainage are not provided. Drainage is needed for best results of most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Procedures that can be used to reclaim the soil include application of gypsum and adequate leaching of salts.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

102—Avenal loam, 0 to 5 percent slopes. This very deep, well drained, nearly level to gently sloping soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. The native vegetation is mainly annual grasses and forbs. Elevation is 500 to 900 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 240 to 260 days.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is grayish brown clay loam about 28 inches thick. The substratum to a depth of 61 inches or more is grayish brown clay loam.

Included in this unit are small areas of Kettleman loam that has slopes of as much as 10 percent, Panoche loam, and Twisselman silty clay. Also included are small areas of soils, in Sunflower Valley and on Kettleman Plain, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Avenal soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat. A few areas are used for irrigated crops.

This unit is well suited to use as rangeland. The production of forage is limited by low precipitation. The amount of forage produced depends mainly on the distribution of the seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the soil from erosion. Leaving sufficient plant cover on the soil helps to control erosion and encourages the production of forage. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water. To prevent wildfires, firebreaks should be disked early in summer, before the annual grasses dry out.

The characteristic plant community on this unit is mainly red brome, filaree, soft chess, foxtail fescue, and allscale saltbush.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of water erosion and moderately slow permeability. Erosion is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are the contour or across the slope. Diversions and grassed waterways may be needed. Waterways should be shaped and seeded to perennial grass.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderately slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops. A cropping system that includes crop rotation and the return of crop residue to the soil conserves moisture, helps to maintain tilth and fertility, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for homesite development, the main limitations are the moderately slow permeability and the hazard of water erosion. The moderately slow permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field.

The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability unit IIe-1 (17), irrigated, and capability subclass VIIe (17), nonirrigated.

103—Boggs sandy loam, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on alluvial plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 190 to 250 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is light brownish gray and grayish brown sandy loam about 15 inches thick. The underlying material to a depth of 60 inches or more is dominantly stratified, light olive gray, light brownish gray, and grayish brown sandy loam and fine sandy loam. In some areas thin layers of gray, dark gray, and light gray sand to clay loam are below a depth of 38 inches. Mottles are in some layers below a depth of 30 inches. The soil is calcareous below a depth of 6 inches, and it is saline-alkali throughout.

Included in this unit are small areas of Armona loam, Houser clay, Lemoore sandy loam, and Westcamp loam that have been partially drained. Also included are small areas of Boggs sandy loam in which the amount of salts has been significantly reduced by partial reclamation and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Boggs soil is moderate. Available water capacity is very low to low. Effective rooting depth

of the crops commonly grown in the area is limited by a perched water table that is at a depth of 36 to 48 inches. This unit is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly barley and cotton. A few areas are used for hay and pasture and for homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, and a stratified profile. Tile drainage can be used if a suitable outlet is available.

Intensive management is required to reduce the salinity and maintain soil productivity. The amount of salts present, the degree of stratification, the crops planted, and the reclamation procedures used affect the yield of crops on this soil. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and the return of crop residue to the soil or the regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus. Furrow, border, and sprinkler irrigation systems are suited to this unit.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and wetness. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Proper drainage and irrigation water management reduce the concentration of salts. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Irrigation water can be applied by the sprinkler and border methods. Leveling helps to insure the uniform application of water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Use of nitrogen and phosphorus promotes good growth of forage plants.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are wetness and the saline-alkali condition of the soil. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and drainage are not provided.

The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. The risk of erosion is increased if the soil is left exposed during site development.

Moderate permeability and wetness increase the possibility of failure of septic tank absorption fields. Community sewage systems are needed to prevent contamination of water supplies as a result of wetness.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

104—Cajon sandy loam. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 210 to 285 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 265 days.

Typically, the surface layer is pale brown sandy loam about 11 inches thick. The upper 49 inches of the underlying material is pale brown loamy sand, and the lower part to a depth of 70 inches is light brownish gray sand. In some areas the surface layer is fine sandy loam or loamy sand.

Included in this unit are small areas of a Cajon sandy loam that is calcareous, small areas of soils that are subject to rare periods of flooding, a Kimberlina fine sandy loam that has a sandy substratum, Nord fine sandy loam, Wasco sandy loam, and soils that are slightly affected by alkali. Also included are small areas of a Kimberlina fine sandy loam that is saline-alkali and a Lemoore sandy loam that has been partially drained. Included areas make up about 15 percent of the total acreage.

Permeability of this Cajon soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more, but roots are mainly in the upper 8 to 15 inches of the soil. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for irrigated crops and for fruit and nuts. Some areas are used for homesite development.

This unit is suited to irrigated crops. It is limited mainly by the low to moderate available water capacity and rapid permeability. These limitations can be compensated for by irrigating the soil in this unit more frequently than the surrounding soils. The slightly alkali-

affected areas can easily be treated by applications of gypsum and by adequate leaching.

Sprinkler irrigation is a suitable method of applying water. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short. The method of irrigation used generally is governed by the crop grown.

A cropping system that includes crop rotation or cover crops and the return of crop residue to the soil conserves moisture, maintains tilth, and controls erosion. Crops respond to nitrogen and phosphorus.

This unit is poorly suited to homesite development. It is limited mainly by the sandy texture of the soil. The risk of erosion is increased if the soil is left exposed during site development. Revegetating disturbed areas helps to control soil blowing.

Because the soil is rapidly permeable, effluent from septic tank absorption fields can contaminate ground water. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage.

This map unit is in capability unit IIIs-4 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

105—Cantua coarse sandy loam, 5 to 15 percent slopes. This deep, somewhat excessively drained, moderately sloping to rolling soil is on hills. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the Cantua soil is grayish brown and light brownish gray coarse sandy loam about 55 inches thick. It is underlain by light brownish gray, soft, calcareous sandstone.

Included in this unit are small areas of Cantua coarse sandy loam that has slopes of as much as 30 percent, Kettleman loam, and Delgado sandy loam and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Cantua soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and wildlife habitat. A few areas are used for barley or cotton and for urban development.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. The amount of forage produced depends mainly on the seasonal precipitation. Overgrazing or a succession of dry years can result in a decrease in desirable grasses and shrubs.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the soil from erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are needed for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, fescue, filaree, and allscale saltbush.

This unit is suited to irrigated crops. It is limited mainly by steepness of slope, the moderately rapid permeability, and the hazard of erosion. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Tillage should be kept to a minimum, and it should be on the contour or across the slope. Soil blowing is reduced by planting crops in alternate strips and at right angle to the prevailing wind.

A cropping system that includes crop rotation and maintains residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen and phosphorus.

This unit is poorly suited to urban development. The main limitations are steepness of slope, shallow depth to soft rock, the hazard of erosion in the steeper areas, and the moderately rapid permeability.

Only the part of the site that is used for construction should be disturbed. The deep cuts needed to provide essentially level building sites can expose bedrock. The risk of erosion is increased if the soil is left exposed during site development. Topsoil can be stockpiled and used to reclaim these areas. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing.

Steepness of slope is a concern in installing septic tank absorption fields. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage. Effluent from absorption fields can surface in areas downslope and create a hazard to health. Absorption lines should be installed on the contour. Structures to divert runoff are needed if buildings and roads are constructed. Establishing and maintaining plant cover can be achieved through proper shaping of the slopes, fertilizing, seeding, and mulching.

This map unit is in capability unit IVe-4 (15), irrigated, and capability subclass VIIe (15), nonirrigated.

106—Cantua coarse sandy loam, 15 to 30 percent slopes. This deep, somewhat excessively drained soil is on hilly uplands. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to

65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the Cantua soil is grayish brown and light brownish gray coarse sandy loam about 55 inches thick. It is underlain by light brownish gray, soft, calcareous sandstone.

Included in this unit are small areas of Cantua coarse sandy loam that has slopes of as little as 5 percent or as much as 50 percent, Kettleman loam that has slopes of as much as 50 percent, and Delgado gravelly sandy loam, Delgado sandy loam, and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Cantua soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as rangeland and for wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. Forage production is mainly dependent upon the seasonal precipitation.

Proper grazing use is essential on this unit. Overgrazing or a succession of dry years can result in a decrease in the production of desirable grasses and shrubs. Livestock grazing should be managed to protect the soil from erosion. Adequate plant cover should be left on the soil to reduce erosion and to help sustain production of forage. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are needed for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

107—Carollo clay loam, 5 to 20 percent slopes. This moderately deep, well drained, saline-alkali soil is on hills. It is undulating to rolling. It formed in residuum derived dominantly from shale. The native vegetation is mainly sparse stands of annual grasses, forbs, and shrubs. Elevation is 300 to 700 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is pale brown clay loam about 2 inches thick. The subsoil is yellowish brown and brown clay about 17 inches thick. The substratum is variegated olive gray and very dark gray clay loam about 13 inches thick. It is underlain by variegated light olive gray and very dark gray shale. A layer of clear, highly fractured crystalline gyspum 1/8 to 1/2 inch thick overlies the substratum in most areas. Mottles are in all layers below a depth of 19 inches. This soil is saline-alkali throughout.

Included in this unit are small areas of Kettleman loam, Cantua coarse sandy loam, Mercey loam, Delgado sandy loam on hilltops, Avenal loam on toe slopes, and a soil that has slopes of as much as 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Carollo soil is very slow. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland and for wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by low rainfall, the saline-alkali condition of the soil, and the hazard of erosion.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Removal of the plant cover by overgrazing or operating off-road vehicles on this unit can result in deterioration of the native plant community and increased erosion. Because of the saline-alkali condition of the soil, adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, filaree, allscale saltbush, and fescue.

This map unit is in capability subclass VIIe (15), nonirrigated.

108—Corona silt loam. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 240 to 280 feet. The average annual precipitation is 8 to 9 inches, the average annual air temperature is 62 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is gray and grayish brown silt loam about 25 inches thick. The upper 17 inches of the subsoil is gray and grayish brown silty clay loam, and the lower 13 inches is pale brown loam. The substratum to a depth of 64 inches or more is light yellowish brown sandy loam. The soil is calcareous to a depth of 55 inches. In some areas the surface layer is silty clay loam.

Included in this unit are small areas of a Kimberlina fine sandy loam that has a sandy substratum, Lakeside clay loam that has been drained, Melga silt loam, Nord fine sandy loam, Remnoy very fine sandy loam, and Whitewolf coarse sandy loam. Also included are small areas of a soil that is similar to this Corona soil but is saline-alkali. Included areas make up about 15 percent of the total acreage.

Permeability of this Corona soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly alfalfa, barley, cotton, corn, and wheat. Among the other crops grown are almonds, walnuts, peaches, and grapes. Some areas are used for homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the slow permeability. Because of this limitation, the application of water should be regulated so that water does not stand on the surface and damage crops. Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Growing cover crops in nontilled orchards increases the penetration of water and helps to control dust. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitation is the slow permeability.

Slow permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability unit IIs-3 (17), irrigated, and capability subclass IVs-3 (17), nonirrigated.

109—Delgado sandy loam, 5 to 15 percent slopes. This shallow, somewhat excessively drained soil is on hills. It is moderately sloping to rolling. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

This soil is light brownish gray sandy loam about 10 inches deep over hard, white, calcareous sandstone. It is calcareous below a depth of 1.5 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Cantua coarse sandy loam, Delgado gravelly sandy loam, and Delgado sandy loam that have slopes of as much as 30 percent, Kettleman loam, Mercey loam, Reefridge clay, and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Delgado soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is medium, and the hazard of water erosion is high.

Most areas of this unit are used as rangeland and wildlife habitat. A few areas are used for irrigated crops.

This unit is poorly suited to use as rangeland. The production of forage is limited by low precipitation, shallow depth to rock, the very low available water capacity, and the hazard of erosion.

Proper grazing use is essential on this unit. Removal of the plant cover by overgrazing or operating off-road vehicles on this unit can result in the deterioration of the native plant community and increased erosion. Livestock grazing should be managed to protect the soil from erosion. Adequate plant cover should be left on the soil to help control erosion and sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This unit is poorly suited to irrigated crops. The main limitations are the shallow depth to hard rock, the very low available water capacity, and the hazard of erosion. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. A cropping system that maintains crop residue on or near the surface conserves moisture, maintains tilth, and controls erosion. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope.

This map unit is in capability subclass VIIe (15), irrigated and nonirrigated.

110—Delgado sandy loam, 15 to 30 percent slopes. This shallow, somewhat excessively drained, hilly soil is on uplands. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

This soil is light brownish gray sandy loam about 10 inches thick. It is underlain by hard, white, calcareous sandstone. The soil is calcareous below a depth of 2 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Cantua coarse sandy loam, Delgado gravelly sandy loam, and Delgado sandy loam that have slopes of as little as 5 percent, Kettleman loam, Mercey loam, Reefridge clay, and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Delgado soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by low precipitation, the

shallow depth to rock, the very low available water capacity, and the hazard of erosion.

Proper grazing use is essential on this unit. Removal of the plant cover by overgrazing or operating off-road vehicles on the unit can result in the deterioration of the native plant community and increased erosion. Livestock grazing should be managed to protect the soil from erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

111—Delgado gravelly sandy loam, 15 to 30 percent slopes. This shallow, somewhat excessively drained soil is on hills. It formed in residuum derived from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

This soil is light brownish gray gravelly sandy loam about 10 inches thick. It is underlain by hard, white, calcareous sandstone. This soil is calcareous below a depth of 2 inches. In some areas the surface layer is gravelly loam.

Included in this unit are small areas of Cantua coarse sandy loam, Delgado sandy loam that has slopes of as little as 5 percent, Kettleman loam, Mercey loam, Reefridge clay, and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Delgado soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by low precipitation, the shallow depth to rock, the very low available water capacity, the hazard of erosion, and the gravelly texture.

Proper grazing use is essential on this unit. Removal of the plant cover by overgrazing or operating off-road vehicles on the unit can result in deterioration of the native plant community and severe erosion. Livestock grazing should be managed to protect the soil from erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

112—Excelsior sandy loam. This very deep, well drained, saline-alkali soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 205 to 275 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 240 to 270 days.

Typically, the surface layer is light brownish gray sandy loam about 8 inches thick. The upper 12 inches of the underlying material is light brownish gray sandy loam, the next 6 inches is pale brown loamy sand, and the lower part to a depth of 60 inches or more is light gray silt loam. The soil is calcareous below a depth of 8 inches, and it is saline-alkali in some parts. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Garces loam, Melga silt loam, Remnoy very fine sandy loam, and Youd fine sandy loam. Also included are small areas of Kimberlina and Nord fine sandy loams that are saline-alkali and soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Excelsior soil is moderate to a depth of 26 inches and slow below this depth. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops and homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and the slowly permeable silt loam layer.

If this unit is irrigated, salinity influences the choice of crops. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Intensive management is required to reduce the salinity and maintain soil productivity. Gypsum is among the soil amendments that can be used to reclaim the soil in this unit. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting,

and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

If this unit is used for homesite development, the main limitations are the saline-alkali condition of the soil and the slow permeability. The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation. The risk of erosion is increased if the soil is left exposed during site development.

This map unit is in capability unit IIs-6 (17), irrigated, and capability subclass VIs (17), nonirrigated.

113—Garces loam. This very deep, well drained, saline-alkali soil is on alluvial fans. It formed in alluvium derived dominantly from granite. Slope is 0 to 2 percent. Elevation is 210 to 250 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 265 days.

Typically, the surface layer is gray fine sandy loam about 1 inch thick. The subsurface layer is light gray loam about 8 inches thick. The subsoil is gray and grayish brown clay loam and sandy clay loam about 13 inches thick. The upper 24 inches of the substratum is light gray and pale yellow sandy loam and coarse sandy loam, the next 9 inches is light gray sandy clay loam, and the lower part to a depth of 60 inches or more is very pale brown fine sandy loam. Yellowish brown mottles are below a depth of 37 inches. The soil is calcareous below a depth of 9 inches. All of the layers are alkali, and most are saline. In some areas the subsurface layer is fine sandy loam.

Included in this unit are small areas of Corona silt loam, Excelsior sandy loam, a Goldberg loam that has been drained, a Kimberlina fine sandy loam that is saline-alkali, and dark colored soils, in low-lying areas, that are not saline-alkali in the upper 20 inches. Also included are small areas of Cajon sandy loam, a Lakeside clay loam that has been drained, and Wasco sandy loam, and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Garces soil is very slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops and for hay and pasture. It is also used for homesite development.

This unit is suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the clay loam and sandy clay loam subsoil and the high content of alkali. The amount of salts present, the crop planted, and the reclamation procedures used affect the yields of crops on this unit.

If this unit is used for irrigated crops, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. Subsoiling improves the water intake rate and allows salts to leach downward. Gypsum can be used to reclaim the soil. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, applications of water should be regulated so that water does not stand on the surface and damage crops.

A cropping system that includes crop rotation and the return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

This unit is suited to hay and pasture. The main limitations are the very slow permeability and the high content of alkali.

Practices that can be used to reclaim the soil in this unit include application of gypsum and adequate leaching of the salts. Subsoiling opens up the soil and allows water and salts to pass through. Salt-tolerant plants are most suitable for planting. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water.

If this unit is used for homesite development, the main limitations are the saline-alkali condition of the soil and the very slow permeability. The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The very slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the

trench and long absorption lines helps to compensate for this limitation.

This map unit is in capability unit IIIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

114—Gaviota-Rock outcrop complex, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly shrubs, annual grasses, and forbs. Elevation is 1,300 to 2,900 feet. The average annual precipitation is 10 to 16 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 200 to 230 days.

This unit is 65 percent Gaviota loam and 20 percent Rock outcrop. The calcareous soil does not differ in use and management from the Gaviota soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Gaviota loam and Rock outcrop that have slopes of as little as 15 percent and Millsholm clay loam. Also included are small areas of Altamont clay, Kreyenhagen loam, Sagaser loam, Vaquero clay, and Wadesprings stony loam. Included areas make up about 15 percent of the total acreage.

The Gaviota soil is shallow and well drained. It formed in residuum derived dominantly from sandstone or shale. Typically, the soil is light yellowish brown loam about 12 inches deep. It is underlain by dark gray sandstone. About 30 percent of this unit is a similar included soil that is calcareous throughout.

Permeability of the Gaviota soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of exposed areas of sandstone or shale.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by the restricted effective rooting depth, the very low to low available water capacity, the presence of shrubs, and the hazard of water erosion. Slope limits access by livestock and results in overgrazing of the less sloping areas. Reducing the amount of brush available as fuel reduces the risk of wildfires.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Leaving sufficient plant cover on the soil helps to control erosion and encourages the production of forage. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly manzanita, black sage, chamise, red brome, and California buckwheat.

This map unit is in capability subclass VIIe (15), nonirrigated.

115—Gepford clay, partially drained. This very deep, poorly drained, saline-alkali soil is on flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 200 to 250 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the surface layer is gray and dark gray clay about 25 inches thick. The upper 13 inches of the underlying material is olive and light gray clay, and the lower part to a depth of 60 inches or more is light olive gray and pale yellow clay loam. Mottles are present in all layers. The soil is calcareous and saline-alkali throughout.

Included in this unit are small areas of Armona loam, Goldberg loam, Houser clay, Lakeside loam, Pitco clay, and Vanguard sandy loam that have been partially drained. Also included are small areas of Gepford clay that has a sandy substratum and has been partially drained, Lethent clay loam, and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Gepford soil is very slow. Available water capacity is low to high because the salinity of the soil varies from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 30 to 48 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is ponded, and the hazard of water erosion is slight. The soil is subject to very long periods of flooding in January through March.

This unit is used mainly for irrigated crops. It is also used for hay and pasture and for homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, the very slow permeability, and very long periods of flooding in years of above normal precipitation.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

The risk of flooding is reduced by the use of levees, canals, and diversions. Tile drainage can be used if a suitable outlet is available.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil, wetness, and very long periods of flooding in years of above normal precipitation. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Proper drainage and irrigation water management reduce the concentration of salts. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer. The risk of flooding is reduced by the use of levees, canals, and diversions.

Irrigation water can be applied by the sprinkler and border methods. Leveling helps to insure the uniform application of water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are wetness, the saline-alkali condition of the soil, the very slow permeability, a high potential for shrinking and swelling, and very long periods of flooding in years of above normal precipitation.

Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The very slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for these limitations.

The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The risk of flooding is reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

116—Gepford clay, sandy substratum, partially drained. This very deep, poorly drained, saline-alkali soil is in basins. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 185 to 195 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray and dark gray clay 25 inches thick. The upper 17 inches of the underlying material is olive and light gray clay, and the lower part to a depth of 60 inches or more is light gray and white fine sand. Mottles are in all layers. This soil is calcareous and saline-alkali throughout. In some areas the surface layer is silty clay.

Included in this unit are small areas of Armona loam, Gepford clay, Homeland fine sandy loam, Tulare clay, Vanguard sandy loam, and Westcamp loam, all of which have been partially drained. Also included are areas of soils that have a sandy substratum at a depth of less than 40 inches and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Gepford soil is very slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 30 to 48 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is ponded, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding in January through March.

This unit is used for irrigated alfalfa, barley, cotton, safflower, and wheat.

This unit is best suited to irrigated, salt- and alkali-tolerant crops. It is limited mainly by the saline-alkali condition of the soil, wetness, a sandy substratum, very slow permeability, and very long periods of flooding in years of above normal precipitation. If the soil is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil.

Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

Tile drainage can be used if a suitable outlet is available. The risk of flooding is reduced by the use of levees, canals, and diversions.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops. The length of runs should be adjusted to permit adequate infiltration of water.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

117—Goldberg loam, drained. This very deep, saline-alkali soil is on alluvial plains and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 205 to 225 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is gray loam and clay loam 6 inches thick. The upper 26 inches of the subsoil is gray, dark gray, and olive gray clay, and the lower 6 inches is gray clay loam. The substratum to a depth of 60 inches or more is light olive gray clay loam and sandy clay loam. Mottles are in some layers below a depth of 6 inches. This soil is calcareous below a depth of 6 inches. It is saline-alkali in some part of the profile.

Included in this unit are small areas of Cajon sandy loam, Garces loam, Kimberlina and Nord fine sandy loams that are saline-alkali, and Whitewolf coarse sandy loam. Also included are small areas of a Goldberg loam that has been partially drained and a Lakeside clay loam that has been drained and small areas of soils that are not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Goldberg soil is very slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding in years of abnormally high precipitation.

This unit is used mainly for irrigated crops. It is also used for hay and pasture and as homesites.

This unit is best suited to irrigated, salt- and alkali-tolerant crops. It is limited mainly by the saline-alkali condition of the soil and the very slow permeability. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this soil. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase. Intensive management is required to reduce the salinity and maintain soil productivity. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Because of the very slow permeability of the soil in this unit, the application of water should be regulated so that water does not stand on the surface and damage the crops. Furrow, border, and sprinkler irrigation systems are suited to this unit. Tilth and fertility can be improved by returning crop residue to the soil. Crops respond to nitrogen and phosphorus.

If this unit is used for hay and pasture, the main limitation is the saline-alkali condition of the soil. The concentration of salts and alkali in the surface layer limits the production of hay and pasture plants. Drainage and good management of irrigation water reduce the concentration of salts. Salt-tolerant species are most suitable for planting. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for homesite development, the main limitations are the very slow permeability, the saline-alkali condition of the soil, and the hazard of flooding. The very slow permeability can cause septic tank absorption fields to fail. Absorption lines should be placed below the very slowly permeable layer. Increasing the size of the absorption area helps to compensate for the very slow permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. The risk of flooding can be reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

118—Goldberg loam, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on alluvial plains and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 210 to 215 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is gray loam about 4 inches thick. The upper 20 inches of the subsoil is gray clay loam, and the lower 20 inches is gray, dark gray, and olive gray clay. The substratum to a depth of 60 inches

or more is light olive gray clay loam and sandy clay loam. Mottles are in all layers below a depth of 4 inches. The soil is calcareous below a depth of 4 inches, and it is saline-alkali in some parts. In some areas the surface layer is clay loam.

Included in this unit are small areas of Armona loam, Gepford clay, Lakeside loam, Lemoore sandy loam, and Vanguard sandy loam that have been drained and Grangeville sandy loam that is saline-alkali. Also included are small areas of soils that are not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Goldberg soil is very slow. Available water capacity is low to high, because the level of salinity differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 36 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding in years of abnormally high precipitation.

This unit is used mainly for irrigated crops. It is also used for hay and pasture and as homesites.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, and the very slow permeability. Tile drainage can be used if a suitable outlet is available.

If this unit is irrigated, salinity influences the choice of crops. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and wetness. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Drainage and irrigation water management reduce the concentration of salts. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are wetness, the very slow permeability, the saline-alkali condition of the soil, and the hazard of flooding. Deep drainage reduces wetness. Tile drainage can be used to reduce wetness if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The very slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for these limitations.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. The risk of flooding can be reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

119—Grangeville sandy loam, saline-alkali. This very deep, somewhat poorly drained soil is on alluvial fans and flood plains. It formed in alluvium derived dominantly from igneous rock. Slope is 0 to 1 percent. Elevation is 190 to 230 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is dark gray sandy loam and loam about 14 inches thick. The underlying material to a depth of 60 inches or more is stratified light olive gray, olive gray, gray, and pale olive sandy loam, fine sandy loam, and very fine sandy loam. In some areas the surface layer is fine sandy loam. Mottles are in all layers below a depth of 21 inches. The soil is calcareous above a depth of 49 inches. It is saline-alkali throughout.

Included in this unit are small areas of Armona loam, Lakeside loam, Vanguard sandy loam, and Grangeville fine sandy loam, saline-alkali, that have been partially drained. Also included are small areas of a Boggs sandy

loam, a Lemoore sandy loam, and a Gepford clay that have been partially drained and a Nord fine sandy loam that is saline-alkali and small areas of soils that are not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Grangeville soil is moderate. Available water capacity is low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth for crops commonly grown in the area is limited by a perched water table that is at a depth of 36 to 48 inches. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding in years of abnormally high precipitation.

This unit is used mainly for irrigated barley and cotton. It is also used for hay and pasture and urban development.

This unit is suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and wetness. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid can be used to reclaim the soil in this unit. Lime should be present in the surface layer if sulfur or sulfuric acid is added. Tile drainage can be used if a suitable outlet is available.

Furrow, border, and sprinkler irrigation systems are suited to this unit. A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and wetness. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Proper drainage and irrigation water management reduce the concentration of salts. Irrigation water can be applied by the border and sprinkler methods.

If this unit is used for urban development, the main limitations are wetness, the saline-alkali condition of the soil, and the hazard of flooding.

Wetness causes septic tank absorption fields to fail. Deep drainage reduces the problem of wetness. Tile drains can be used if a suitable outlet is available.

Drainage is needed for best results with most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Plants that tolerate wetness and droughtiness should be selected if irrigation and drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. The risk of flooding can be reduced by the use of levees, canals, and diversions.

The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

120—Grangeville fine sandy loam, partially drained. This very deep, somewhat poorly drained soil is on alluvial fans and flood plains. It formed in alluvium derived dominantly from igneous rock. Slope is 0 to 1 percent. Elevation is 210 to 285 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is grayish brown fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified light gray, light brownish gray, pale brown, and very pale brown sandy loam and fine sandy loam. In some areas the surface layer is sandy loam. Mottles are in all layers below a depth of 21 inches.

Included in this unit are small areas of Nord fine sandy loam, a Vanguard sandy loam that has been partially drained, Whitewolf coarse sandy loam, a Kimberlina fine sandy loam that is saline-alkali, and Wasco sandy loam. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Grangeville soil is moderately rapid. Available water capacity is moderate to high. Effective rooting depth for crops commonly grown in the area may be limited by a water table that is perched at a depth of more than 48 inches. This soil is considered to be partially drained because of the dams and reservoirs in the Sierra Nevada, pumping from the water table, the use of tile and interceptor drains, and filling and leveling of the sloughs in the vicinity. Runoff is slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

Most areas of this unit are used for irrigated crops, mainly alfalfa, barley, corn, cotton, and wheat. Among the other crops grown are peaches and walnuts. Some areas are used for homesite development.

This unit is well suited to irrigated crops. It is limited mainly by wetness. Deep-rooted crops are suited to areas where the drainage is adequate or where a drainage system has been installed.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid overirrigating and leaching of plant nutrients.

A cropping system that includes crop rotation or cover crops and the return of crop residue to the soil conserves moisture and helps to maintain tilth and fertility. Generally, all crops respond to phosphorus and all crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitation is wetness, which can cause septic tank absorption fields to fail. Deep drainage reduces the problem of wetness.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIw-2 (17), irrigated, and capability subclass VIw (17), nonirrigated.

121—Grangeville fine sandy loam, saline-alkali, partially drained. This very deep, somewhat poorly drained soil is on alluvial fans and flood plains. It formed in alluvium derived dominantly from igneous rock. Slope is 0 to 1 percent. Elevation is 210 to 285 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is grayish brown fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified light gray, light brownish gray, pale brown, and very pale brown sandy loam and fine sandy loam. In some areas the surface layer is sandy loam. Mottles are in all layers below a depth of 21 inches. The soil is saline-alkali throughout.

Included in this unit are small areas of Grangeville fine sandy loam that has been partially drained, a Nord fine sandy loam that is saline-alkali, Whitewolf coarse sandy loam, a Kimberlina fine sandy loam that is saline-alkali, and a Vanguard sandy loam that has been partially drained. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Grangeville soil is moderate. Available water capacity is low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth for crops commonly grown in the area is limited in some areas by a water table that is perched at a depth of more than 48 inches. This soil is considered to be partially drained because of the dams and reservoirs of the Sierra Nevada, pumping from the water table, tile and interceptor drains, and filling and leveling of the sloughs in the vicinity. Runoff is slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

This unit is used mainly for irrigated crops, such as alfalfa, barley, and cotton. It is also used for hay and pasture and for homesite development.

This unit is suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and by wetness. Intensive management is required to reduce the salinity and maintain soil productivity. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum can be used to reclaim the soil. Deep-rooted crops are suited to areas where drainage is adequate or where a drainage system has been installed. Furrow, border, and sprinkler irrigation systems are suited to this unit.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum. Generally, all crops respond to phosphorus and all crops except legumes respond to nitrogen.

If this unit is used for hay and pasture, the main limitation is the saline-alkali condition of the soil. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Procedures that can be used to reclaim the soil include application of gypsum and adequate leaching of the salts. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to homesite development. The main limitations are wetness and the saline-alkali condition of the soil. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion. Wetness can cause septic tank absorption fields to fail. Deep drainage reduces the problem of wetness.

Landscaping plants that tolerate wetness and droughtiness should be selected if irrigation and drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used in this soil.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

122—Henneke very gravelly clay loam, 5 to 15 percent slopes. This shallow, well drained soil is on hills. It is moderately sloping to rolling. The soil formed in residuum derived dominantly from serpentine. The native vegetation is mainly brush, annual grasses, some perennial grasses, forbs, and trees. Elevation is 3,000 to 3,473 feet. The average annual precipitation is 16 to 18

inches, the average annual air temperature is 59 to 61 degrees F, and the average frost-free period is 200 to 240 days.

Typically, the surface layer is dark grayish brown very gravelly clay loam about 3 inches thick. The subsoil is dark brown and brown very gravelly clay about 15 inches thick. Pale yellow, very dark gray, and white serpentine and other metavolcanic rock are at a depth of 18 inches. In some areas the surface layer is very cobbly clay loam or gravelly loam.

Included in this unit are small areas of Altamont clay, Vaquero clay, Wadesprings stony loam, Rock outcrop, and Henneke very gravelly clay loam that has slopes of as much as 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Henneke soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by the presence of brush and trees, coarse fragments on the surface, limited effective rooting depth, very low available water capacity, and the unfavorable calcium-to-magnesium ratio of the soil.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Leaving adequate plant cover on the surface helps to control erosion and encourages the production of forage. Emergency seeding with adapted grasses or other plants following fire helps to stabilize the soil and to control soil erosion. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly soft chess, wild oat, buckbrush, Digger pine, and manzanita.

This map unit is in capability subclass VIIe (15), nonirrigated.

123—Henneke very gravelly clay loam, 15 to 50 percent slopes. This shallow, well drained soil is on hills (fig. 6). It formed in residuum derived dominantly from serpentine. The native vegetation is mainly brush, annual grasses, some perennial grasses, forbs, and trees. Elevation is 1,800 to 3,400 feet. The average annual precipitation is 16 to 18 inches, the average annual air temperature is 59 to 61 degrees F, and the average frost-free period is 200 to 240 days.

Typically, the surface layer is dark grayish brown very gravelly clay loam about 3 inches thick. The subsoil is dark brown and brown very gravelly clay about 15 inches thick. Pale yellow, very dark gray, and white serpentine and other metavolcanic rock are at a depth of 18 inches. In some areas the surface layer is very cobbly clay loam or gravelly loam.

Included in this unit are small areas of Altamont clay, Henneke very gravelly clay loam that has slopes of as little as 5 percent, Vaquero clay, and Wadesprings stony loam. Also included are small areas of Millsholm clay loam and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Henneke soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by the presence of brush and trees, coarse fragments on the surface, limited effective rooting depth, very low available water capacity, the hazard of water erosion, and the unfavorable calcium-to-magnesium ratio of the soil.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Leaving sufficient plant cover on the surface helps to control erosion and encourages the production of forage. Emergency seeding with adapted grasses or other plants following fire helps to stabilize the soil and to control erosion. Correct placement of salt and feed supplement helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly manzanita, Digger pine, soft chess, wild oat, buckbrush, and needlegrass.

This map unit is in capability subclass VIIe (15), nonirrigated.

124—Homeland fine sandy loam, partially drained. This very deep, poorly drained, saline-alkali soil is on basin rims. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 185 to 220 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 255 to 270 days.

Typically, the surface layer is light olive gray fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray, pale yellow, and white, stratified very fine sandy loam, sandy loam, loamy sand, and loamy fine sand. Mottles are in some layers below a depth of 8 inches. The soil is saline-alkali throughout. In some areas the surface layer is loam or loamy sand.

Included in this unit are small areas of Houser clay and small areas of Tulare clay and Westcamp loam that have been partially drained. Also included are small

Figure 6.—Area of Henneke very gravelly clay loam, 15 to 50 percent slopes, in foreground; Chalk Buttes in background.

areas of Armona and Lakeside loams that have been partially drained, a Rambla loamy sand that has been drained, and soils that are not subject to flooding. Included areas make up about 10 percent of the total acreage.

Permeability of this Homeland soil is moderate. Available water capacity is very low to low because the salinity of the soil varies from one area to another. Effective rooting depth for the crops commonly grown in the area is limited by a perched water table that is at a depth of 24 to 48 feet. This soil is considered to be partially drained because of dams and reservoirs in the Sierra Nevada, pumping from the water table, and drainage canals. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding in years of abnormally high precipitation.

This unit is used for irrigated barley or cotton.

This unit is suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by wetness, the strong saline-alkali condition of the soil, the hazard of flooding, and the sandy texture of the soil. The amount of salts present, the crops planted, and the reclamation procedures used affect the yields of crops. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short.

If the unit is used for irrigated crops, salinity influences the choice of crops. Tilth and fertility can be improved by returning crop residue to the soil. Crops respond to nitrogen and phosphorus.

Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper

amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid can be used to reclaim the soil in this unit. Lime should be present in the surface layer if sulfur or sulfuric acid is added.

Tile drainage can be used if a suitable outlet is available. Flooding can be controlled by the use of levees, canals, and diversions.

If this unit is used for homesite development, the main limitations are wetness, the strong saline-alkali condition of the soil, the hazard of flooding, and the sandy texture of the soil. Flooding can be controlled by the use of levees, canals, and diversions.

Wetness causes septic tank absorption fields to fail. Deep drainage reduces the problem of wetness. Tile drains can be used if a suitable outlet is available.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The sandy texture of the soil provides poor foundation support for buildings. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The risk of erosion is increased if the soil is left exposed during site development. Revegetating disturbed areas helps to control erosion.

This map unit is in capability unit IIIw-4 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

125—Houser fine sandy loam, drained. This very deep, saline-alkali soil is on basin rims. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 190 to 220 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is light gray fine sandy loam 4 inches thick. The upper 10 inches of the underlying material is light gray clay, and the lower part to a depth of 60 inches or more is light gray and light brownish gray silty clay. The soil is calcareous throughout. Below a depth of 4 inches, it is mottled and is saline-alkali.

Included in this unit are small areas of Houser clay and Westcamp loam that have been partially drained, Rambla loamy sand that has been drained, Lethent clay loam, and Lethent fine sandy loam. Also included are small areas of soils that are not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Houser soil is very slow. Available water capacity is very low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding in February and March. It is considered to be drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the use of drainage canals.

This unit is used for irrigated crops.

This unit is best suited to irrigated, salt- and alkali-tolerant crops. It is limited mainly by the saline-alkali condition of the soil, the very slow permeability, and very long periods of flooding in years of abnormally high precipitation. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage crops. The risk of flooding is reduced by the use of levees, canals, and diversions.

A cropping system that includes crop rotation and the return of crop residue to the soil or the regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for homesite development, the main limitations are the very slow permeability, the saline-alkali condition of the soil, high shrink-swell potential, and very long periods of flooding in years of abnormally high precipitation. The very slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

Buildings and roads should be designed to offset the effects of shrinking and swelling. The effects can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential. The risk of flooding is reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

126—Houser clay, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on basin

rims. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 180 to 210 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is light olive gray and gray clay about 20 inches thick. The upper 3 inches of the underlying material is light olive gray silt loam, and the lower part to a depth of 60 inches or more is gray and olive gray clay. The soil is calcareous above a depth of 20 inches and is saline-alkali below a depth of 9 inches. In some areas the surface layer is silty clay.

Included in this unit are small areas of Houser fine sandy loam and Rambla loamy sand that have been drained and small areas of Lethent clay loam. Also included are small areas of Boggs sandy loam, Gepford clay, Tulare clay, and Westcamp loam that have been partially drained and small areas of soils that are not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Houser soil is very slow. Available water capacity is very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 48 to 72 inches. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding in February and March. The soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the use of drainage canals.

This unit is used for irrigated barley, cotton, and safflower.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, the very slow permeability, wetness, and very long periods of flooding in years of abnormally high precipitation.

Intensive management is required to reduce the salinity and maintain soil productivity. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on the unit. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Tile drainage can be used if a suitable outlet is available. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase. The risk of flooding is reduced by the use of levees, canals, and diversions.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage crops. A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for homesite development, the main limitations are wetness, the very slow permeability, the saline-alkali condition of the soil, high potential for shrinking and swelling, and very long periods of flooding in years of abnormally high precipitation.

The very slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for the very slow permeability. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

Selection of adapted vegetation is critical for establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

Buildings and roads should be designed to offset the effects of shrinking and swelling. The effects can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The risk of flooding is reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

127—Kettleman loam, 5 to 15 percent slopes. This moderately deep, well drained soil is on hills. It is moderately sloping to rolling. The soil formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is brown loam about 13 inches thick. The next layer is grayish brown loam about 26 inches thick. It is underlain by grayish brown, calcareous sandstone. This soil is calcareous below a depth of 1 inch. In some areas the soil is clay loam throughout.

Included in this unit are small areas of Cantua coarse sandy loam, a Kettleman loam that has slopes of as much as 30 percent, Mercey loam, Reefridge clay, and Delgado sandy loam and small areas of Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Kettleman soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used as rangeland and wildlife habitat. A few areas are used for barley and for urban development.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. The amount of forage produced depends on the seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Removal of the plant cover by overgrazing or operating off-road vehicles can result in the deterioration of the native plant community and in increased erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, ripgut brome, filaree, and allscale saltbush.

This unit is suited to irrigated crops. It is limited mainly by steepness of slope, the hazard of erosion, and the moderate depth to rock. Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope. Crops respond to nitrogen and phosphorus.

Population growth has resulted in increased construction of homes on this unit. If the unit is used for urban development, the main limitations are steepness of slope, moderate depth to rock, and the hazard of erosion in steeper areas.

Only the part of the site that is used for construction should be disturbed. The deep cuts needed to provide essentially level building sites can expose bedrock. Topsoil can be stockpiled and used to reclaim areas of this unit. Preserving the existing plant cover during construction helps to control erosion.

Steepness of slope is a concern in installing septic tank absorption fields. Effluent from absorption fields can surface in areas downslope and create a hazard to health; therefore, if the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage. Absorption lines should be installed on the contour.

Structures to divert runoff are needed if buildings and roads are constructed. Establishing and maintaining plant cover can be achieved through proper shaping of the slopes, fertilizing, seeding, and mulching.

This map unit is in capability unit IVe-1 (15), irrigated, and capability subclass VIIe (15), nonirrigated.

128—Kettleman loam, 15 to 30 percent slopes. This moderately deep, well drained soil is on hilly uplands. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is brown loam about 13 inches thick. The underlying material is grayish brown loam about 26 inches thick. It is underlain by grayish brown, calcareous sandstone. This soil is calcareous below a depth of 1 inch. In some areas the soil is clay loam throughout.

Included in this unit are small areas of Cantua coarse sandy loam that has slopes of as much as 50 percent, Kettleman soils that have slopes of 30 to 50 percent, and Reefridge clay. Also included are small areas of Delgado gravelly sandy loam and Rock outcrop on hilltops. Included areas make up about 15 percent of the total acreage.

Permeability of this Kettleman soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. Forage production varies with the seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Removal of the plant cover by overgrazing or operating off-road vehicles on the unit can result in deterioration of the native plant community and in increased erosion. Adequate plant cover should be left on the unit to reduce erosion and help sustain forage production.

Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, ripgut brome, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

129—Kettleman-Cantua complex, 30 to 50 percent slopes. This map unit is on hills. It formed in residuum

derived dominantly from sandstone and shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 2,000 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

This unit is 50 percent Kettleman loam and 40 percent Cantua coarse sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a Delgado gravelly sandy loam that is on hilltops and has slopes of 15 to 50 percent and small areas of Mercey loam. Also included are small areas of Rock outcrop on ridgetops. Included areas make up about 10 percent of the total acreage.

The Kettleman soil is moderately deep and well drained. It formed in residuum derived from sandstone or shale. Typically, the surface layer is brown loam about 13 inches thick. The underlying material is grayish brown loam about 26 inches thick. It is underlain by grayish brown, calcareous sandstone. The soil is calcareous below a depth of 1 inch.

Permeability of this Kettleman soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Cantua soil is deep and somewhat excessively drained. It formed in residuum derived from sandstone. Typically, the Cantua soil is grayish brown and light brownish gray coarse sandy loam about 55 inches thick. It is underlain by light brownish gray, soft, calcareous sandstone.

Permeability of this Cantua soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall, steepness of slope, and the hazard of erosion. Forage production varies with the seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Operating off-road vehicles on the unit can result in deterioration of the native plant community. Adequate plant cover should be left on the unit to reduce erosion and help sustain forage production.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed to encourage livestock grazing in areas where access is limited. Correct placement of salt and supplemental feed also helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, ripgut brome, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

130—Kimberlina fine sandy loam, saline-alkali. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 220 to 250 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the soil is light brownish gray fine sandy loam to a depth of 60 inches or more. It is calcareous below a depth of 8 inches and is saline-alkali throughout. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Cajon sandy loam, Kimberlina fine sandy loam that has a sandy substratum, Nord fine sandy loam that is saline-alkali, and Wasco sandy loam. Also included are small areas of Excelsior sandy loam, Garces loam, Melga silt loam, Remnoy very fine sandy loam, and Youd fine sandy loam and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Kimberlina soil is moderately slow. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops and for hay and pasture. It is also used for urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil. Intensive management is required to reduce the salinity of the soil and maintain productivity. Content of the toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderately slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

This unit is suited to hay and pasture. The main limitation is the saline-alkali condition of the soil. The concentration of salts and alkali limits the production of

some hay and pasture plants. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Irrigation water can be applied by the sprinkler and border methods. Leveling helps to insure the uniform application of water.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

Population growth has resulted in increased construction of homes on this unit. The main limitation for homesite development is the saline-alkali condition of the soil. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

This map unit is in capability unit IIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

131—Kimberlina fine sandy loam, sandy substratum. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 250 to 1,000 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 64 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the surface layer is light brownish gray fine sandy loam about 8 inches thick. The upper 33 inches of the underlying material is light brownish gray and grayish brown fine sandy loam, and the lower part to a depth of 60 inches or more is brown loamy fine sand. This soil is calcareous between depths of 8 and 28 inches and is noncalcareous below a depth of 28 inches. In some areas the surface layer is sandy loam or loam.

Included in this unit are small areas of Cajon sandy loam, Excelsior sandy loam, a Kimberlina fine sandy loam that is saline-alkali, Nord fine sandy loam, and Wasco sandy loam. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Kimberlina soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more, but roots are mainly in the upper 40 to 60 inches of the soil. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops such as alfalfa, cotton, barley, grapes, and almonds. It is also used for homesite development.

This unit is suited to most irrigated crops. It is limited mainly by the moderate available water capacity and by the sandy substratum, which restricts rooting depth of deep-rooted crops.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs to avoid overirrigating and leaching of plant nutrients.

A cropping system that includes crop rotation or cover crops and return of crop residue to the soil conserves moisture, maintains tilth, and controls erosion. Generally, all crops respond to phosphorus and all crops except legumes respond to nitrogen.

If this unit is used for homesite development, it has few limitations; however, the risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from septic tank absorption fields.

This map unit is in capability unit IIs-4 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

132—Kimberlina, saline-alkali-Garces complex. This map unit is on alluvial fans. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses and forbs. Elevation is 210 to 250 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 265 days.

This unit is 50 percent Kimberlina fine sandy loam, saline-alkali, and 35 percent Garces loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cajon sandy loam, a Goldberg loam and a Lakeside clay loam that have been drained, and a Lemoore sandy loam that has been partially drained. Also included are small areas of Nord fine sandy loam, most of which is saline-alkali, and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

The Kimberlina soil is very deep and well drained. It formed in alluvium derived dominantly from igneous and sedimentary rock. Typically, the soil is light brownish gray fine sandy loam to a depth of 60 inches or more. It is calcareous below a depth of 8 inches and is saline-alkali throughout. In some areas the surface layer is sandy loam.

Permeability of the Kimberlina soil is moderately slow. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Garces soil is very deep and well drained. It formed in alluvium derived dominantly from granite. Typically, the surface layer is gray fine sandy loam about 1 inch thick. The subsurface layer is light gray loam about 8 inches thick. The subsoil is gray and grayish brown clay loam and sandy clay loam about 13 inches thick. The upper 24 inches of the substratum is light gray and pale yellow sandy loam and coarse sandy loam, the next 9 inches is light gray sandy clay loam, and the lower part to a depth of 60 inches or more is very pale brown fine sandy loam. Yellowish brown mottles are in all layers below a depth of 37 inches. The soil is calcareous below a depth of 9 inches. All layers are alkali-affected, and most are saline-affected. In some areas the subsurface layer is fine sandy loam.

Permeability of the Garces soil is very slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops and pasture. It is also used for homesite development.

This unit is suited to irrigated crops that are salt- and alkali-tolerant. If the Kimberlina soil is used for irrigated crops, the main limitation is the saline-alkali condition of the soil. If the Garces soil is used for irrigated crops, the main limitations are the saline-alkali condition of the soil and the very slow permeability.

Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the Garces soil, the application of water should be regulated so that water does not stand on the surface and damage the crops. Subsoiling improves the water intake rate and allows salts to be leached downward. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

This unit is suited to hay and pasture. If the Kimberlina soil is used for hay and pasture, the main limitation is the saline-alkali condition of the soil. If the Garces soil is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and the very slow permeability.

The concentration of salts and alkali limits the production of some hay and pasture plants. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Subsoiling opens up the soil and allows water and salts to pass through.

Irrigation water can be applied by the sprinkler and border methods. Leveling helps to insure the uniform application of water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

If the Kimberlina soil is used for homesite development, the main limitation is the saline-alkali condition of the soil. If the Garces soil is used for homesite development, the main limitations are the saline-alkali condition of the soil and the very slow permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The very slow permeability of the Garces soil can cause septic tank absorption fields to fail. Increasing the size of the absorption area helps to compensate for this limitation. Absorption lines should be placed below the very slowly permeable layer.

The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

133—Kreyenhagen loam, 50 to 75 percent slopes. This deep, well drained soil is on mountains. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly annual grasses, forbs, and

deciduous trees. Elevation is 1,100 to 2,550 feet. The average annual precipitation is 12 to 18 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 210 to 240 days.

Typically, the surface layer is pale brown loam about 2 inches thick. The subsoil is yellowish brown clay loam about 43 inches thick. Brownish yellow sandstone is at a depth of 45 inches.

Included in this unit are small areas of Altamont clay, Sagaser loam, Vaquero clay, and Wadesprings stony loam. Also included are small areas of Gaviota loam and Millsholm clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Kreyenhagen soil is moderately slow. Available water capacity is moderate to very high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing, wildlife habitat, firewood production, and watershed.

The production of forage on this unit is limited by the hazard of water erosion. Slope limits access by livestock and results in overgrazing of the less sloping areas. Livestock grazing should be managed to protect the soil from erosion. Proper grazing use is essential on this unit. Adequate plant cover should be left on the unit to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

Harvesting of firewood is limited mainly by steepness of slope. Because of the instability of the soil, trees and brush should be retained on this unit.

The characteristic plant community on this unit is mainly blue oak, wild oat, and soft chess. The potential production of the understory is about 1,600 pounds of air-dry vegetation per acre per year.

This map unit is in capability subclass VIIe (15), nonirrigated.

134—Lakeside loam, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on basin rims and alluvial plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and a few valley oaks. Elevation is 190 to 240 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray and olive gray loam and fine sandy loam about 17 inches thick. The underlying material to a depth of 60 inches or more is stratified, light olive gray, pale yellow, olive gray, and grayish brown loam and clay loam. Mottles are in all layers below a depth of 28 inches. The soil is calcareous below a depth of 4 inches, and it is saline-alkali throughout. In some areas the surface layer is clay loam.

Included in this unit are small areas of Armona loam, Goldberg loam, Homeland fine sandy loam, Lakeside clay, and Westcamp loam that have been partially drained and Grangeville sandy loam that is saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Lakeside soil is moderately slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 48 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

This unit is used mainly for irrigated alfalfa, barley, and cotton. It is also used for urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, the stratified underlying material, and wetness.

If this unit is irrigated, salinity influences the choice of crops. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Tile drainage can be used if a suitable outlet is available. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for urban development are wetness, the saline-alkali condition of the soil, and the moderately slow permeability. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The moderately slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench

and long absorption lines helps to compensate for these limitations.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

135—Lakeside clay loam, drained. This very deep, saline-alkali soil is on basin rims and alluvial plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 220 to 260 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray clay loam about 17 inches thick. The underlying material to a depth of 60 inches or more is stratified, light gray, light olive gray, pale yellow, and grayish brown sandy loam, loam, and clay loam. Mottles are in all layers below a depth of 28 inches. The soil is calcareous below a depth of 4 inches, and it is saline-alkali throughout. In some areas the surface layer is loam.

Included in this unit are small areas of Corona silt loam, Excelsior sandy loam, Garces loam, Kimberlina fine sandy loam that is saline-alkali, Melga silt loam, and Grangeville fine sandy loam that has been partially drained and is saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Lakeside soil is moderately slow. Available water capacity is moderate to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. This soil is considered to be drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the filling and leveling of the sloughs in the vicinity. The soil is protected from flooding by large flood control structures.

This unit is used mainly for irrigated alfalfa, barley, cotton, safflower, and wheat. It is also used for homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and the stratified underlying material.

If this unit is irrigated, salinity influences the choice of crops. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are the saline-alkali condition of the soil and the moderately slow permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The moderately slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

136—Lakeside clay, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on basin rims and alluvial plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 205 to 215 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray clay about 12 inches thick. The underlying material to a depth of 60 inches or more is stratified, light gray, light olive gray, and pale yellow sandy loam. Mottles are in all layers below a depth of 28 inches. The soil is calcareous and saline-alkali throughout. In some areas the surface layer is clay loam.

Included in this unit are small areas of Goldberg loam that has been drained, Grangeville sandy loam that is saline-alkali, and Lakeside loam that has been drained. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 12 percent of the total acreage.

Permeability of this Lakeside soil is slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited

by a perched water table that is at a depth of 48 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

This unit is used mainly for irrigated crops. It is also used for urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, the stratified underlying material, and slow permeability. Tile drainage can be used if a suitable outlet is available.

If this unit is irrigated, salinity influences the choice of crops. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Subsoiling opens up the soil and allows water and salts to pass through. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for urban development are wetness, slow permeability, and the saline-alkali condition of the soil. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for these limitations.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIw (17), nonirrigated.

137—Lemoore sandy loam, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 210 to 225 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the soil is light brownish gray sandy loam to a depth of 60 inches or more. Mottles are in all layers below a depth of 16 inches. The soil is calcareous below a depth of 7 inches. It is saline-alkali in some parts. In some areas the surface layer is fine sandy loam.

Included in this unit are small areas of Kimberlina fine sandy loam, Grangeville sandy loam, and Nord fine sandy loam that are saline-alkali and Grangeville fine sandy loam that is saline-alkali and has been partially drained. Also included are small areas of Cajon sandy loam and small areas of Boggs sandy loam and Lakeside loam that have been partially drained. Included areas make up about 15 percent of the total acreage.

Permeability of this Lemoore soil is moderate. Available water capacity is very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 36 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops and urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by wetness and the saline-alkali condition of the soil.

If this unit is irrigated, salinity influences the choice of crops. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. Intensive management is required to reduce the salinity and maintain soil productivity. Tile drainage can be used if a suitable outlet is available. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderate permeability

of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for urban development, the main limitations are wetness and the saline-alkali condition of the soil.

Wetness can cause septic tank absorption fields to fail. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

This map unit is in capability unit IIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

138—Lethent fine sandy loam. This very deep, moderately well drained, saline-alkali soil is on basin rims. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 205 to 210 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is light brownish gray fine sandy loam 8 inches thick. The subsoil is light gray and light brownish gray clay 13 inches thick. The upper 14 inches of the underlying material is light olive gray and pale olive loam, and the lower part to a depth of 60 inches or more is light olive gray and white clay loam. This soil is calcareous and saline-alkali throughout. In some areas the surface layer is silt loam.

Included in this unit are small areas of Excelsior sandy loam, Garces loam, and Lethent and Westhaven clay loams that are saline-alkali. Also included are small areas of soils, in the southeastern corner of the survey area, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Lethent soil is very slow. Available water capacity ranges from very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops.

This unit is best suited to irrigated, salt- and alkali-tolerant crops. It is limited mainly by the saline-alkali condition of the soil and the very slow permeability. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and the return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops. Crops respond to nitrogen and phosphorus.

If this unit is used for homesite development, the main limitations are the potential for shrinking and swelling, the very slow permeability, and the saline-alkali condition of the soil. Buildings and roads should be designed to offset the effects of shrinking and swelling. The effects can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The very slow permeability can cause septic tank absorption fields to fail. Increasing the size of the absorption area helps to compensate for this limitation. Absorption lines should be placed below the very slowly permeable layer.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

139—Lethent clay loam. This very deep, moderately well drained, saline-alkali soil is on lower lying alluvial fans and basin rims. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 1 percent. Elevation is 190 to 500 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is pale brown clay loam about 6 inches thick. The upper 18 inches of the subsoil

is light brownish gray clay, and the lower 7 inches is light brownish gray clay loam. The substratum to a depth of 60 inches or more is light yellowish brown sandy loam. This soil is calcareous to a depth of 24 inches. It is saline-alkali in some parts. In some areas the surface layer is silty clay loam or silt loam.

Included in this unit are small areas of Garces loam, Gepford clay and Houser clay that have been partially drained, and Panoche clay loam and Twisselman silty clay that are saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 12 percent of the total acreage.

Permeability of this Lethent soil is very slow. Available water capacity is low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops and urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and the very slow permeability. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. If the saline-alkali condition is significantly reduced by reclamation, the permeability and available water capacity increase.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

If this unit is used for urban development, the main limitations are the potential for shrinking and swelling, the very slow permeability, and the saline-alkali condition of the soil. Buildings and roads should be designed to offset the effects of shrinking and swelling. The effects can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

The very slow permeability can cause septic tank absorption fields to fail. Increasing the size of the absorption area helps to compensate for this limitation. Absorption lines should be placed below the very slowly permeable layer.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. The effect of the clayey texture and the saline-alkali condition of the soil on shrubs and trees can be minimized by digging through the clay subsoil and backfilling with coarser textured material that is not saline-alkali. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

This map unit is in capability unit IIIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

140—Melga silt loam. This very deep, somewhat poorly drained, saline-alkali soil is on flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 220 to 280 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is dark grayish brown loam about 1 inch thick. The subsurface layer is light gray silt loam about 3 inches thick. The subsoil is dark grayish brown silty clay loam and clay loam about 14 inches thick. The next layer to a depth of 26 inches is a very pale brown, weakly cemented layer. The upper 8 inches of the substratum is very pale brown clay loam that is weakly cemented with lime and silica, the next 15 inches is very pale brown silt loam, and the lower part to a depth of 60 inches or more is light yellowish brown very fine sandy loam and fine sandy loam. The soil is calcareous between depths of 4 and 59 inches and is noncalcareous below. It is saline-alkali between depths of 4 and 41 inches and is alkali below. In some areas the subsurface layer is loam.

Included in this unit are small areas of Corona silt loam, Excelsior sandy loam, Garces loam, Remnoy very fine sandy loam, and Youd fine sandy loam. Also included are small areas of Kimberlina fine sandy loam that is saline-alkali, Lakeside clay loam that has been drained, and soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Melga soil is very slow. Available water capacity is moderate to high because the salinity of the soil differs from one area to another. Effective rooting depth is only 10 to 20 inches unless the weakly cemented layer is ripped. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to brief periods of flooding in February and March.

This unit is used for irrigated crops, hay and pasture, dairies, and homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the weakly cemented layer, the saline-alkali condition of the soil, brief periods of flooding, and very slow permeability. Ripping and shattering the weakly cemented layer increases the effective rooting depth and improves internal drainage.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Permeability and available water capacity increase if the weakly cemented layer is ripped, and the saline-alkali of the soil condition is significantly reduced by reclamation. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on the unit. Crops respond to nitrogen and phosphorus.

The risk of flooding is reduced by the use of levees, canals, and diversions. Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for hay and pasture, the main limitations are the weakly cemented layer, the saline-alkali condition of the soil, and very slow permeability. Ripping and shattering the weakly cemented layer increases the effective rooting depth and improves internal drainage.

The concentration of salts and alkali limits the production of some hay and pasture plants. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

If this unit is used for homesite development, the main limitations are the weakly cemented layer, the saline-alkali condition of the soil, brief periods of flooding, and very slow permeability. The weakly cemented layer is rippable and therefore is not a serious limitation for most engineering uses.

The very slow permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field. The suitability of the soil for septic tank absorption fields can also be improved by ripping the weakly cemented layer to increase permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

The risk of flooding is reduced by the use of levees, canals, and diversions. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

141—Mercey loam, 5 to 15 percent slopes. This moderately deep, well drained soil is on hills. It is moderately sloping to rolling. The soil formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is light yellowish brown loam about 3 inches thick. The subsoil is light yellowish brown clay loam about 13 inches thick. The substratum to a depth of 25 inches is light yellowish brown loam. Light yellowish brown sandstone is at a depth of 25 inches. The soil is calcareous below a depth of 3 inches.

Included in this unit are small areas of Avenal loam and Panoche loam on toe slopes, Delgado sandy loam on hilltops, Cantua coarse sandy loam, Kettleman loam, Reefridge clay, Carollo clay loam, and Mercey loam that has slopes of as much as 30 percent. Also included are small areas of slick spots that are saline-alkali. Included areas make up about 15 percent of the total acreage.

Permeability of this Mercey soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of

erosion. The amount of forage produced depends mainly on the seasonal precipitation.

Proper grazing use is essential on this unit. Removal of the plant cover by overgrazing or using off-road vehicles can result in the deterioration of the native plant community and in increased erosion. Livestock grazing should be managed to protect the unit from erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain production of forage. Correct placement of salt and supplemental feed helps to distribute grazing and to prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

142—Mercey loam, 15 to 30 percent slopes. This moderately deep, well drained, hilly soil is on uplands. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is light yellowish brown loam about 3 inches thick. The subsoil is light yellowish brown clay loam about 13 inches thick. The substratum to a depth of 25 inches is light yellowish brown loam. Light yellowish brown sandstone is at a depth of 25 inches. The soil is calcareous below a depth of 3 inches.

Included in this unit are small areas of Delgado sandy loam on hilltops, Cantua coarse sandy loam, Kettleman loam, Carollo clay loam, and Reefridge clay. Also included are small areas of Mercey loam that has slopes of as little as 5 percent to as much as 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Mercey soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. The amount of forage produced depends mainly on the seasonal precipitation.

Proper grazing use is essential on this unit. Removal of the plant cover by overgrazing or using off-road vehicles can result in the deterioration of the native plant community and in increased erosion. Livestock grazing should be managed to protect the unit from erosion. Mechanical treatment practices are not feasible because of the steepness of slope. Adequate plant cover should be left on the soil to reduce erosion and help sustain production of forage. Correct placement of salt and supplemental feed helps to distribute grazing and to prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

143—Mercey loam, 30 to 50 percent slopes. This moderately deep, well drained soil is on uplands. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly annual grasses, forbs, and shrubs. Elevation is 500 to 1,500 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is light yellowish brown loam about 3 inches thick. The subsoil is light yellowish brown clay loam about 13 inches thick. The substratum to a depth of 25 inches is light yellowish brown loam. Light yellowish brown sandstone is at a depth of 25 inches. This soil is calcareous below a depth of 3 inches.

Included in this unit are small areas of Delgado sandy loam on hilltops, Kettleman loam, Cantua coarse sandy loam, Mercey loam that has slopes of as little as 15 percent, and Rock outcrop on ridgetops. Included areas make up about 15 percent of the total acreage.

Permeability of this Mercey soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall, steepness of slope, and the hazard of erosion. The amount of forage produced depends mainly on the seasonal precipitation. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed to encourage livestock grazing in areas where access is limited. Use of off-road vehicles can result in the deterioration of the native plant community and in increased erosion.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and to prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, foxtail fescue, filaree, and allscale saltbush.

This map unit is in capability subclass VIIe (15), nonirrigated.

144—Milham sandy loam, silty substratum. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 2 percent. Elevation is 200 to 500 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 270 days.

Typically, the surface layer is light yellowish brown sandy loam about 14 inches thick. The subsoil is light yellowish brown sandy clay loam about 14 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown loam and silty clay loam. The soil is calcareous below a depth of 14 inches. In some areas the surface layer is loam or fine sandy loam.

Included in this unit are small areas of a Kimberlina fine sandy loam that has a sandy substratum, Garces loam, Panoche loam, and Wasco sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Milham soil is slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly barley and cotton. Among the other crops grown are pistachios, almonds, alfalfa, and tomatoes. Some areas are used as wildlife habitat.

This unit is well suited to irrigated crops. It is limited mainly by slow permeability. Growing cover crops in nontilled almond orchards increases the water intake rate and helps to control dust.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

A cropping system that includes crop rotation and return of crop residue to the soil conserves moisture, helps to maintain tilth and fertility, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitation is slow permeability. The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IIs-3 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

145—Millsholm clay loam, 15 to 50 percent slopes. This shallow, well drained soil is on hills. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly annual grasses, forbs, brush, and trees. Elevation is 1,800 to 3,000 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 210 to 240 days.

Typically, the surface layer is yellowish brown clay loam about 4 inches thick. The subsoil is yellowish brown clay loam about 13 inches thick. Light yellowish brown sandstone is at a depth of 17 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Altamont clay, Gaviota loam, Vaquero clay, and Millsholm clay loam that has slopes of as much as 75 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Millsholm soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing, firewood production, wildlife habitat, and watershed.

The production of forage on this unit is limited by the restricted effective rooting depth and the very low to low available water capacity. Livestock grazing should be managed to protect the unit from erosion. Proper grazing use is essential on this unit. Leaving sufficient plant cover on the unit helps to control erosion and encourages the production of forage. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water. Leaving the vegetation in drainageways and leaving eight to ten trees per acre helps to control erosion and enhances wildlife habitat and esthetic value. Onsite investigation is necessary prior to mechanical treatment.

The characteristic plant community on this unit is mainly blue oak, Digger pine, soft chess, and red brome. The potential production of the understory is about 800 pounds of air-dry vegetation per acre per year.

This map unit is in capability subclass VIe (15), nonirrigated.

146—Millsholm clay loam, 50 to 75 percent slopes. This shallow, well drained soil is on mountains. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly annual grasses, forbs, brush, and trees. Elevation is 1,400 to 3,200 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 210 to 240 days.

Typically, the surface layer is yellowish brown clay loam about 4 inches thick. The subsoil is yellowish brown clay loam about 13 inches thick. Light yellowish brown sandstone is at a depth of 17 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Altamont clay, Gaviota loam, and Vaquero clay. Also included are small areas of Henneke very gravelly clay loam that has

slopes of as little as 30 percent, Kreyenhagen loam, and Sagaser loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Millsholm soil is moderate. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing, wildlife habitat, and watershed.

The production of forage on this unit is limited by the shallow rooting depth and the very low to low available water capacity. Slope limits access by livestock and results in overgrazing of the less sloping areas. Livestock grazing should be managed to protect the unit from erosion. Proper grazing use is essential on this unit. Leaving sufficient plant cover on the unit helps to control erosion and encourages the production of forage. Correct placement of salt and supplemental feed helps to distribute livestock grazing and to prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water. Because of the instability of the soil, trees and shrubs should be retained on the unit.

The characteristic plant community on this unit is mainly blue oak, Digger pine, soft chess, and wild oat. The potential production of the understory is about 800 pounds of air-dry vegetation per acre per year.

This map unit is in capability subclass VIIe (15), nonirrigated.

147—Nord fine sandy loam. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 210 to 290 feet. The average annual precipitation is 8 to 9 inches, the average annual air temperature is 61 to 62 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The upper 34 inches of the underlying material is brown fine sandy loam and very fine sandy loam, and the lower part to a depth of 72 inches is dark grayish brown and grayish brown fine sandy loam. The soil is calcareous between depths of 9 and 52 inches and is noncalcareous below.

Included in this unit are small areas of Grangeville fine sandy loam that has been partially drained, Lakeside clay loam that has been drained, Nord fine sandy loam that is saline-alkali, and Whitewolf coarse sandy loam. Also included are small areas of Cajon sandy loam, Kimberlina fine sandy loam that has a sandy substratum, and soils, near the Kings River, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Nord soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly alfalfa, cotton, barley, and grapes. Among the other crops grown are corn, wheat, almonds, walnuts, apricots, and peaches. Some areas are used for urban development.

This unit is well suited to irrigated crops. It has few limitations.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderate permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. Growing cover crops in nontilled fruit and nut orchards increases the penetration of water and helps to control dust.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

This unit is well suited to urban development. It has few limitations. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The map unit is in capability class I (17), irrigated, and capability subclass IVc (17), nonirrigated.

148—Nord fine sandy loam, saline-alkali. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 200 to 290 feet. The average annual precipitation is 8 to 9 inches, the average annual air temperature is 61 to 62 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The upper 34 inches of the underlying material is brown fine sandy loam and very fine sandy loam, and the lower part to a depth of 72 inches is dark grayish brown and grayish brown fine sandy loam. The soil is calcareous between depths of 9 and 52 inches and is noncalcareous below. It is saline-alkali throughout.

Included in this unit are small areas of Grangeville fine sandy loam that has been partially drained and is saline-alkali, Lakeside clay loam that has been drained, Nord fine sandy loam, and Whitewolf coarse sandy loam. Also included are small areas of Cajon sandy loam, Kimberlina fine sandy loam that is saline-alkali, Vanguard sandy loam that has been partially drained, and soils, near the Kings River, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Nord soil is moderately slow. Available water capacity ranges from low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly cotton and barley. Among the other crops grown are alfalfa, corn, and grapes. Some areas are used for homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and the moderately slow permeability.

If this unit is irrigated, salinity influences the choice of crops. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. Intensive management is required to reduce the salinity and maintain soil productivity. Content of toxic salts can be reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

This unit is suited to homesite development. The main limitations are the saline-alkali condition of the soil and the moderately slow permeability. The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

The moderately slow permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field.

This map unit is in capability units IIs-6 (17), irrigated, and IVs-6 (17), nonirrigated.

149—Nord complex. This map unit is on alluvial fans. Slope is 0 to 1 percent. Elevation is 200 to 290 feet. The average annual precipitation is 8 to 9 inches, the average annual air temperature is 61 to 62 degrees F, and the average frost-free period is 250 to 260 days.

This unit is 50 percent Nord fine sandy loam and 40 percent Nord fine sandy loam, saline-alkali. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a Grangeville fine sandy loam that has been partially drained and is saline-alkali in places, a Lakeside clay loam that has been drained, and Whitewolf coarse sandy loam. Also included are small areas of Kimberlina fine sandy loam that has a sandy substratum or that is saline-alkali, Cajon sandy loam, and soils, near the Kings River, that are subject to rare periods of flooding. Included areas make up about 10 percent of the total acreage.

The Nord fine sandy loam is very deep and well drained. It formed in alluvium derived dominantly from igneous and sedimentary rock. Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The upper 34 inches of the underlying material is brown fine sandy loam and very fine sandy loam, and the lower part to a depth of 72 inches is dark grayish brown and grayish brown fine sandy loam. This soil is calcareous between depths of 9 and 52 inches and is noncalcareous below.

Permeability of the Nord fine sandy loam is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Nord fine sandy loam, saline-alkali, is very deep and well drained. It formed in alluvium derived dominantly from igneous and sedimentary rock. Typically, the surface layer is grayish brown fine sandy loam about 18 inches thick. The upper 34 inches of the underlying material is brown fine sandy loam and very fine sandy loam, and the lower part to a depth of 72 inches is dark grayish brown and grayish brown fine sandy loam. This soil is calcareous between depths of 9 and 52 inches and is noncalcareous below. It is saline-alkali throughout.

Permeability of the Nord fine sandy loam, saline-alkali, is moderately slow. Available water capacity is low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly alfalfa, cotton, barley, and grapes. Among the other crops grown are corn, wheat, fruit, and nuts. This unit can be used for walnuts, peaches, and apricots if the saline-alkali areas are reclaimed. Some areas are used for urban development.

The Nord fine sandy loam, saline-alkali, is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali areas, which are intermingled with nonsaline-nonalkali areas. Limited growth and vigor of crops is characteristic of areas of this unit (fig. 7). The amount of salts present, the crops planted, and the reclamation procedures used affect the yields of crops.

If this unit is used for irrigated crops, salinity influences the choice of crops in some areas. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is

Figure 7.—Peach orchard in an area of Nord complex. Variation in size of trees is a result of the content of salts and alkali in the soils.

reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, or sulfuric acid can be used to reclaim the saline-alkali areas. Lime should be present in the surface layer if sulfur or sulfuric acid is added. Furrow, border, and sprinkler irrigation systems are suited to this unit.

Tilth and fertility can be improved by returning crop residue to the soil. Generally, all crops respond to phosphorus and all crops except legumes respond to nitrogen.

This unit is suited to urban development. The main limitations are the saline-alkali areas, which are highly corrosive to steel and concrete, and the moderately slow permeability, which can cause septic tank absorption fields to fail. Treated steel pipe and sulfate resistant concrete should be used. The risk of erosion is increased if the soil is left exposed during site development. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability units IIs-6 (17), irrigated, and IVs-6 (17), nonirrigated.

150—Panoche loam. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and shrubs. Elevation is 240 to 1,300 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the soil is light brownish gray, grayish brown, and brown loam to a depth of 60 inches or more. It is calcareous below a depth of 7 inches.

Included in this unit are small areas of Avenal loam, Kettleman loam that is on toe slopes and has slopes of as much as 10 percent, Panoche clay loam that is saline-alkali, Twisselman silty clay, and Wasco sandy loam. Also included are small areas of Kimberlina fine sandy loam that has a sandy substratum, Milham sandy loam that has a silty substratum, Westhaven loam, and Panoche soil that has slopes of more than 2 percent and small areas of soils, in Sunflower Valley and Kettleman Plain, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Panoche soil is moderate. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops and as rangeland. A few areas are used for nonirrigated grain crops and urban development.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderate permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Growing cover crops in nontilled orchards increases the penetration of water, reduces runoff and erosion, and helps to control dust. Most crops except legumes respond to nitrogen; all crops respond to phosphorus. Nonirrigated grain crops are limited mainly by the lack of rainfall sufficient to bring them to maturity. In most years, when precipitation is above normal, the nonirrigated barley can be harvested.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall. The amount of forage produced depends mainly on the distribution of seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Leaving sufficient plant cover on the unit helps to control erosion and encourages the production of forage.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Correct placement of salt and supplemental feed helps to better distribute livestock grazing and to prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

This unit is suited to urban development. The main limitations are the moderate permeability and medium runoff.

The moderate permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The risk of erosion is increased if the soil is left exposed during site development. Structures to divert runoff are needed if buildings and roads are constructed.

This map unit is in capability class I (17), irrigated, and capability subclass VIIc (17), nonirrigated.

151—Panoche clay loam, saline-alkali. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 1 percent. The vegetation in areas not cultivated is mainly annual grasses, forbs, and shrubs. Elevation is 200 to 450 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the soil is grayish brown clay loam to a depth of 60 inches or more. It is calcareous and saline-alkali throughout.

Included in this unit are small areas of Avenal loam, Lethent clay loam, Panoche loam, and a Westhaven clay loam and a Twisselman silty clay that are saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Panoche soil is moderately slow. Available water capacity is low to high because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops. It is also used as rangeland.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. Intensive management is needed to reduce the salinity and maintain the productivity of the soil. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum can be used to reclaim the soil in this unit.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum. Crops respond to nitrogen and phosphorus.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the saline-alkali condition of the soil. The amount of forage produced depends on the seasonal precipitation.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, filaree, saltgrass, and allscale saltbush.

This unit is suited to homesite development. The main limitations are the moderately slow permeability and the saline-alkali condition of the soil, which causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil.

The moderately slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

Selection of adapted vegetation is critical for establishment of lawns, shrubs, trees, and vegetable gardens.

This map unit is in capability unit IIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

152—Parkfield Variant gravelly clay loam, 2 to 8 percent slopes. This moderately deep, well drained soil is on stream terraces. It formed in alluvium derived dominantly from sedimentary rock. The native vegetation is mainly annual grasses and forbs. Elevation is 800 to 1,000 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is dark grayish brown gravelly clay loam about 4 inches thick. The upper 11 inches of the subsoil is dark grayish brown clay loam, and the lower 17 inches is grayish brown clay. The substratum to a depth of 35 inches is light yellowish brown clay. Pale yellow very cobbly sandstone is at a depth of 35 inches. It is weakly cemented with lime.

Included in this unit are small areas of Delgado sandy loam that is on hilltops and has slopes of as much as 15 percent, Avenal loam, and Panoche loam on toe slopes. Included areas make up about 10 percent of the total acreage.

Permeability of this Parkfield Variant soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The amount of forage produced depends mainly on the seasonal precipitation.

Proper grazing use is essential on this unit. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Water troughs and tanks are necessary for livestock because of the limited water supply.

The characteristic plant community on this unit is mainly red brome, barley, soft chess, filaree, and foxtail fescue.

This map unit is in capability subclass VIe (17), nonirrigated.

153—Pitco clay, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on basin rims and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 190 to 210 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is dark gray and gray clay about 23 inches thick. The underlying material to a depth of 60 inches or more is stratified, dark gray and olive gray clay loam and clay. Mottles are in all layers below a depth of 16 inches. The soil is saline-alkali throughout.

Included in this unit are small areas of Armona loam, Gepford clay, Tulare clay, Vanguard sandy loam that has been partially drained, and soils that have a calcareous surface layer. Also included are areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Pitco soil is very slow. Available water capacity is very low to moderate because the salinity of the soil varies from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 48 to 60 inches or more. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

This unit is used mainly for irrigated crops. It is also used for hay and pasture.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, and very slow permeability. Tile drainage can be used if a suitable outlet is available.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the

salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface and damage the crops.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil, wetness, and very slow permeability. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Proper drainage and irrigation water management reduce the concentration of salts.

Irrigation water can be applied by the furrow and border methods. Leveling helps to insure the uniform application of water. Because of the very slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

If this unit is used for homesite development, the main limitations are wetness, the saline-alkali condition of the soil, very slow permeability, and the high potential of shrinking and swelling. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The very slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Increasing the size of the absorption field and backfilling with sand help to overcome these limitations.

The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

154—Pits and Dumps. This map unit consists of areas from which soil and parent material have been removed and areas of uneven accumulation of waste material. These areas are rock quarries; sand and gravel borrow pits; old, abandoned, dissected sloughs; refuse disposal sites; and mines. The largest area is the gypsum quarry southeast of Reef City. Another area is the gravel pit west of Reef City. Drainage channels cut across some areas. Some sites are subject to seasonal flooding and ponding. The elevation is 200 to 3,400 feet. The vegetation is mainly sparse annual grasses and forbs. A few areas near mines also support trees and shrubs.

Included in this unit are small areas of Cajon sandy loam, Delgado sandy loam that has slopes of as much as 30 percent, Henneke very gravelly clay loam that has slopes of as much as 50 percent, and Kimberlina fine sandy loam that is saline-alkali or that has a sandy substratum. Also included are small areas of Nord fine sandy loam, some areas of which are saline-alkali; Panoche loam; and Wasco sandy loam.

Drainage, permeability, surface runoff, depth of the root zone, and available water capacity are all variable. The hazard of erosion is high.

This unit has no value for farming.

This map unit is in capability subclass VIIIe (17, 15).

155—Rambla loamy sand, drained. This very deep, saline-alkali soil is on basin rims. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 190 to 235 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray loamy sand about 15 inches thick. The upper 4 inches of the underlying material is gray loamy fine sand, the next 26 inches is gray and very pale brown clay, and the lower part to a depth of 60 inches or more is light gray loamy sand. Mottles are in most layers below a depth of 19 inches. The soil is saline-alkali in some parts. In some areas the surface layer is sand.

Included in this unit are small areas of Homeland fine sandy loam, Houser clay, and Westcamp loam that have been partially drained; Houser fine sandy loam that has been drained; and Twisselman silty clay. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Rambla soil is moderately rapid to a depth of 19 inches and very slow below this depth.

Available water capacity is very low to moderate because the salinity of the soil varies from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is considered to be drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the use of drainage canals.

This unit is used for irrigated barley and cotton.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, the very low to moderate available water capacity, highly stratified soil layers, and the hazard of soil blowing. The amount of salts present, the degree of stratification, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. If the saline-alkali condition of the soil is significantly reduced by reclamation, the permeability and available water capacity increase.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. Subsoiling improves the water intake rate and allows salts to leach downward. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Crops that are tolerant of drought are best suited because the available moisture is not adequate for good growth of most other crops. A cropping system that includes crop rotation and maintains crop residue on or near the surface conserves moisture, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen and phosphorus.

Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil is droughty, applications of irrigation water should be light and frequent.

If this unit is used for homesite development, the main limitations are the saline-alkali condition of the soil and very slow permeability. The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The very slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

The risk of erosion is increased if the soil is left exposed during site development. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing.

This map unit is in capability unit IIs-4 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

156—Reefridge clay, 5 to 15 percent slopes. This deep, well drained soil is on hills. It is moderately sloping and rolling. The soil formed in residuum derived dominantly from shale and sandstone. The native vegetation is mainly annual grasses and forbs. Elevation is 700 to 2,000 feet. The average annual precipitation is about 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 230 to 250 days.

Typically, the surface layer is brown and light yellowish brown clay about 14 inches thick. The underlying material to a depth of 48 inches is light olive brown clay. Light olive gray, olive yellow, and yellow interbedded shale and sandstone are at a depth of 48 inches. Mottles and lime are below a depth of 14 inches. The soil is saline below a depth of 14 inches.

Included in this unit are small areas of Delgado sandy loam on hilltops, Kettleman loam, Mercey loam, and a Reefridge clay that has slopes of as much as 30 percent. Also included are small areas of Panoche loam on toe slopes. Included areas make up about 10 percent of the total acreage.

Permeability of this Reefridge soil is slow; however, the infiltration rate is high when the soil is dry and the cracks in the soil are open. As the soil becomes wet and the cracks close, the infiltration rate drastically decreases. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall. The amount of forage produced depends mainly on the seasonal precipitation.

Proper grazing use is essential on this unit. Adequate plant cover should be left on the soil to reduce erosion and help sustain forage production. Grazing should be delayed until the soil is firm and the more desirable forage plants have had an opportunity to set seed. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

Areas of this unit are difficult to fence. Excessive shrinking and swelling of the soil lifts fenceposts out of the ground.

The characteristic plant community on this unit is mainly red brome, ripgut brome, clover, wild oat, barley, and filaree.

This map unit is in capability subclass VIIe (15), nonirrigated.

157—Reefridge clay, 15 to 30 percent slopes. This deep, well drained, hilly soil is on uplands. It formed in residuum derived dominantly from shale and sandstone. The native vegetation is mainly annual grasses and forbs. Elevation is 700 to 2,000 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 230 to 250 days.

Typically, this soil is brown clay about 56 inches thick. It is underlain by light olive gray, olive yellow, and yellow shale. Mottles and lime are below a depth of 30 inches. The soil is saline below a depth of 30 inches.

Included in this unit are small areas of Delgado sandy loam on hilltops, Kettleman loam, Mercey loam, and a Reefridge clay that has slopes of as little as 5 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this Reefridge soil is slow; however, the infiltration rate is high when the soil is dry and the cracks in the soil are open. As the soil becomes wet and the cracks close, the infiltration rate drastically decreases. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and wildlife habitat.

This unit is suited to use as rangeland. The production of forage is limited by low rainfall and the hazard of erosion. The amount of forage produced depends mainly on the seasonal precipitation.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Adequate plant cover should be left on the unit to reduce erosion and help sustain forage production. Grazing should be delayed until the soil is firm and the more desirable forage plants have had an opportunity to set seed. Correct placement of salt and supplemental feed helps to distribute grazing and prevent overgrazing. Livestock watering troughs and tanks are needed because of the limited water supply.

Areas of this unit are difficult to fence. Excessive shrinking and swelling of the soil lifts fenceposts out of the ground.

The characteristic plant community on this unit is mainly red brome, ripgut brome, wild oat, barley, clover, and filaree.

This map unit is in capability subclass VIIe (15), nonirrigated.

158—Remnoy very fine sandy loam. This shallow, somewhat poorly drained, saline-alkali soil is on alluvial fans and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 2 percent. Elevation is 225 to 300 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is light brownish gray very fine sandy loam about 1 inch thick. The subsurface layer is light gray very fine sandy loam about 4 inches thick. The subsoil is light gray clay loam about 10 inches thick. The next layer to a depth of 29 inches is a light gray hardpan that is cemented with lime and silica. The substratum to a depth of 70 inches or more is stratified, light gray and light brownish gray silt loam and sandy loam. Mottles are in most layers below a depth of 5 inches. The soil is calcareous to a depth of 63 inches. It is saline-alkali throughout. In some areas the surface layer is silt loam or loam.

Included in this unit are small areas of a Kimberlina fine sandy loam that is saline-alkali, Excelsior sandy loam, Garces loam, and Melga silt loam. Also included are small areas of a Lakeside clay loam that has been drained, a Nord fine sandy loam that is saline-alkali, a soil that is more than 20 inches deep to a hardpan, and Remnoy very fine sandy loam that is not flooded. Included areas make up about 15 percent of the total acreage.

Permeability of this Remnoy soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very slow, and the hazard of water erosion is slight. The soil is subject to brief periods of flooding late in winter and early in spring.

This unit is used for irrigated crops and for hay and pasture.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the hardpan, the saline-alkali condition of the soil, the very low available water capacity, brief periods of flooding, and slow permeability. Ripping and shattering the hardpan increases the effective rooting depth and improves internal drainage.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Permeability and available water capacity increase if the hardpan is ripped and the saline-alkali condition of the soil is significantly reduced by reclamation. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. Crops respond to nitrogen and phosphorus.

The risk of flooding is reduced by the use of levees, canals, and diversions. Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for hay and pasture, the main limitations are the hardpan, the saline-alkali condition of the soil, and very low to moderate available water capacity. Ripping and shattering the hardpan increases the effective rooting depth and improves internal drainage.

The concentration of salts and alkali limits the production of some hay and pasture plants. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

If this unit is used for homesite development, the main limitations are the hardpan, slow permeability, the saline-alkali condition of the soil, and brief periods of flooding. The hardpan is rippable and therefore is not a serious limitation for most engineering uses.

The slow permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field. The suitability of the unit for septic tank absorption fields can be improved by ripping the hardpan to increase permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts. The risk of flooding is reduced by the use of levees, canals, and diversions. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IVs-8 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

159—Rock outcrop-Dystric Lithic Xerochrepts complex, 30 to 100 percent slopes. This map unit is on ridges. The native vegetation is mainly shrubs, trees, annual grasses, and forbs. Elevation is 1,400 to 3,200 feet. The average annual precipitation is 10 to 18 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 200 to 240 days.

This unit is 50 percent Rock outcrop and 40 percent Dystric Lithic Xerochrepts. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Altamont clay, Gaviota loam, Millsholm clay loam, and Vaquero clay. These included areas have slopes of as little as 15 percent and as much as 75 percent. They make up about 10 percent of the total acreage.

Rock outcrop consists of exposed areas of highly fractured, acid shale.

Because the shale Rock outcrop is highly fractured, infiltration is very rapid. Most of the precipitation that falls on the surface enters the shale through these fractures and is used by shrubs and trees. Runoff is very slow.

Dystric Lithic Xerochrepts are very shallow and excessively drained. They formed in residuum derived dominantly from acid shale. Typically, these soils are grayish brown very shaly sandy loam or shaly sandy loam about 6 inches deep. They are underlain by light brownish gray, acid shale.

Permeability of Dystric Lithic Xerochrepts is rapid. Available water capacity is very low. Effective rooting depth is 0.25 to 7.0 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as wildlife habitat and watershed. Precipitation is stored in the fractures of the Rock outcrop and surfaces downslope in the form of seeps.

This map unit is in capability subclass VIIIs (15), nonirrigated.

160—Rock outcrop-Lithic Torriorthents complex, 15 to 75 percent slopes. This map unit is on ridges. The native vegetation is mainly annual grasses, forbs, shrubs, and deciduous trees. Elevation is 500 to 2,200 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 65 degrees F, and the average frost-free period is 230 to 250 days.

This unit is 50 percent Rock outcrop and 40 percent Lithic Torriorthents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Delgado sandy loam, Delgado gravelly sandy loam, and Reefridge clay, all of which have slopes of 15 to 30 percent. Included areas make up about 10 percent of the total acreage.

Rock outcrop is composed of highly fractured shale. Because the shale Rock outcrop is highly fractured, infiltration is very rapid. Most of the precipitation that falls on the surface enters the shale through these fractures and is used by shrubs and trees. Runoff is very slow.

Lithic Torriorthents are very shallow and excessively drained. They formed in residuum derived dominantly

from shale. Typically, these soils are pale brown shaly clay loam or very shaly clay loam about 2 inches thick. They are underlain by white and strong brown shale.

Permeability of Lithic Torriorthents is moderate. Available water capacity is very low. Effective rooting depth is 0.25 to 7.0 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as wildlife habitat and watershed. Precipitation is stored in the fractures of the Rock outcrop and surfaces downslope in the form of seeps.

This map unit is in capability subclass VIIIs (15), nonirrigated.

161—Sagaser loam, 50 to 75 percent slopes. This deep, well drained soil is on north aspects of mountains. It formed in residuum derived dominantly from sandstone or shale. The native vegetation is mainly trees, shrubs, annual grasses, and forbs. Elevation is 1,800 to 3,200 feet. The average annual precipitation is 10 to 18 inches, the average annual air temperature is 59 to 61 degrees F, and the average frost-free period is 200 to 240 days.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is brown, yellowish brown, and light yellowish brown clay loam about 28 inches thick. The substratum is light yellowish brown shaly clay loam about 8 inches thick. It is underlain by light gray, highly fractured shale.

Included in this unit are small areas of Altamont clay, Kreyenhagen loam, Sagaser loam that has slopes of as little as 30 percent, and Vaquero clay. Also included are small areas of Gaviota loam, Millsholm clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Sagaser soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used livestock grazing, wildlife habitat, and watershed.

The production of forage is limited by the presence of brush and trees and the hazard of water erosion. Slope limits access by livestock and results in overgrazing of the less sloping areas. Livestock grazing should be managed to protect the unit from erosion. Proper grazing use is essential on this unit. Leaving sufficient plant cover on the unit helps to control erosion and encourages the production of forage. Correct placement of salt and supplemental feed helps to distribute livestock grazing and to prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water. Because of the instability of the soil, trees and brush should be retained on this unit. The potential production of the understory is about 1,800 pounds of air-dry vegetation per acre per year.

This map unit is in capability subclass VIIe (15), nonirrigated.

162—Sandridge loamy fine sand. This very deep, somewhat excessively drained, alkali soil is on basin rims. It formed in windblown deposits derived dominantly from igneous and sedimentary rock. Slope is 0 to 3 percent. Elevation is 195 to 220 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 255 to 270 days.

Typically, the surface layer is grayish brown and light gray loamy fine sand about 24 inches thick. The underlying material to a depth of 60 inches or more is light gray loamy fine sand. The soil is alkali below a depth of 24 inches, and it is calcareous throughout. In some areas the surface layer is sand.

Included in this unit are small areas of Excelsior sandy loam, Houser fine sandy loam, and Rambla loamy sand that have been drained and Westcamp loam that has been partially drained. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 8 percent of the total acreage.

Permeability of this Sandridge soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used for irrigated crops and wildlife habitat (fig. 8).

This unit is poorly suited to irrigated crops. It is limited mainly by the low to moderate available water capacity, moderately rapid permeability, the hazard of soil blowing, and the alkali condition of the lower part of the soil. The low to moderate available water capacity and moderately rapid permeability of the soil in this unit can be compensated for by irrigating it more frequently than the surrounding soils.

Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Crop residue left on or near the surface conserves moisture, maintains tilth, and controls erosion. Tillage should be kept to a minimum. Soil blowing is reduced by planting crops in alternate strips and at right angles to the prevailing wind. Crops respond to nitrogen and phosphorus.

This map unit is in capability unit IIIe-4 (17), irrigated, and capability subclass VIIe (17), nonirrigated.

Figure 8.—Typical area of Sandridge loamy fine sand used for wildlife habitat.

163—Tulare clay, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is in basins. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 178 to 195 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is gray clay about 16 inches thick. The underlying material to a depth of 60 inches or more is light gray, light olive gray, and grayish brown clay. Mottles are in most layers below a depth of 1 inch. The soil is saline-alkali in some parts, and it is calcareous throughout. In some areas the surface layer is silty clay.

Included in this unit are small areas of Gepford clay that has a sandy substratum, Houser clay, Homeland fine sandy loam, Lakeside clay, Lakeside loam, and Pitco clay. These areas have been partially drained and are near the basin rim. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 10 percent of the total acreage.

Permeability of this Tulare soil is very slow. Available water capacity is moderate. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 48 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the use of drainage canals. Runoff is ponded, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding in January through March.

This unit is used for irrigated alfalfa, barley, cotton, safflower, and wheat.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, very long periods of flooding in years of above normal precipitation, and very

slow permeability. Tile drainage can be used if a suitable outlet is available. The risk of flooding is reduced by the use of levees, canals, and diversions.

If this unit is irrigated, salinity influences the choice of crops. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

This map unit is in capability unit IIIw-5 (17), irrigated, and capability subclass VIw (17), nonirrigated.

164—Tulare Variant clay, partially drained. This very deep, poorly drained, saline-alkali soil is on basin rims and flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 195 to 210 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is dark gray and gray clay about 10 inches thick. The upper 46 inches of the underlying material is gray, dark gray, and olive gray clay, and the lower part to a depth of 60 inches or more is light olive gray fine sandy loam. Mottles are in all layers below a depth of 2 inches. The soil is saline-alkali throughout, and it is calcareous above a depth of 47 inches.

Included in this unit are small areas of Gepford and Pitco clays that have been partially drained and Lethent clay loam. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 10 percent of the total acreage.

Permeability of this Tulare Variant soil is very slow. Available water capacity is very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 36 to 48 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is ponded, and the hazard of water erosion is slight. This soil is protected from flooding by large flood control structures.

This unit is used for irrigated crops.

This unit is suited to only the most salt- and alkali-tolerant, irrigated crops. It is limited mainly by the saline-alkali condition of the soil, wetness, and very slow permeability. Tile drainage can be used if a suitable outlet is available.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface and damage the crops. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate.

This map unit is in capability unit IIIw-5 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

165—Twisselman silty clay. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 1 percent. Elevation is 230 to 900 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 270 days.

Typically, the surface layer is light brownish gray silty clay about 9 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale yellow silty clay. The soil is calcareous throughout. In some areas the surface layer is clay.

Included in this unit are small areas of Avenal loam, Lethent clay loam, and Panoche loam. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Twisselman soil is slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops.

This unit is well suited to irrigated crops. It is limited mainly by slow permeability. Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the slow permeability of the soil, the

application of water should be regulated so that water does not stand on the surface and damage the crops.

A cropping system that includes crop rotation and return of crop residue to the soil conserves moisture, helps to maintain tilth and fertility, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitation is slow permeability. The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability unit IIs-5 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

166—Twisselman silty clay, saline-alkali. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Slope is 0 to 1 percent. Elevation is 205 to 240 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 250 to 270 days.

Typically, the surface layer is light brownish gray silty clay about 9 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale yellow silty clay. The soil is calcareous and saline-alkali throughout. In some areas the surface layer is clay.

Included in this unit are small areas of Panoche clay loam and Westhaven clay loam that are saline-alkali, Garces loam, Lethent clay loam, and Lethent fine sandy loam. Also included are small areas of Houser clay and Westcamp loam that have been partially drained and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Twisselman soil is very slow. Available water capacity is very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare periods of flooding in years of abnormally high precipitation.

This unit is used for irrigated crops.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and very slow permeability.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer. If the saline-alkali condition of the soil is significantly reduced by reclamation, the permeability and available water capacity increase. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit.

A cropping system that includes crop rotation and the return of crop residue to the soil conserves moisture, helps to maintain tilth and fertility, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for homesite development, the main limitations are the saline-alkali condition of the soil, the very slow permeability, and rare periods of flooding. The saline-alkali condition cause high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The very slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

The risk of flooding can be reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

167—Urban land. This map unit consists of land covered by streets, parking lots, buildings, airstrips, and other structures that obscure or alter the soils so that identification is not feasible. The largest areas are covered by the cities of Hanford, Lemoore, Corcoran, Avenal, Armona, Stratford, and Kettleman City and by part of Lemoore Naval Air Station. Elevation is 185 to 900 feet.

Included in this unit are areas of Nord fine sandy loam that is saline-alkali in some places, in the cities of Hanford and Armona; Kimberlina fine sandy loam that is saline-alkali, in the city of Hanford; Grangeville sandy loam that is saline-alkali, in the cities of Lemoore and Stratford; Lemoore sandy loam that has been partially drained, in the city of Lemoore; and Armona loam that has been partially drained, in the city of Stratford. Also included are areas of Lethent clay loam on Lemoore Naval Air Station; Lakeside loam that has been partially drained, in the city of Corcoran; Kimberlina fine sandy loam that has a sandy substratum, in Kettleman City; and Wasco sandy loam that has slopes of as much as 5 percent and Panoche loam, in the city of Avenal.

This map unit is not placed in an interpretative group.

168—Vanguard sandy loam, partially drained. This very deep, poorly drained, saline-alkali soil is on flood plains. It formed in alluvium derived dominantly from igneous rock. Slope is 0 to 1 percent. Elevation is 190 to 220 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is 250 to 260 days.

Typically, the surface layer is dark gray and grayish brown sandy loam about 16 inches thick. The underlying material to a depth of 60 inches or more is stratified, light brownish gray, gray, and light olive gray fine sandy loam, silt loam, loam, and sandy clay loam. Mottles are in all layers below a depth of 34 inches. The soil is calcareous in most layers below a depth of 6 inches, and it is saline-alkali throughout. In some areas the surface layer is loam.

Included in this unit are small areas of Armona loam, Boggs sandy loam, Gepford clay, and Lakeside loam that have been partially drained and Grangeville sandy loam that is saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Vanguard soil is moderate. Available water capacity is moderate to high because the salinity of the soil differs from one area to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 24 to 36 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, use of tile and interceptor drains, and the filling and leveling of the sloughs in the vicinity. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to long periods of flooding in February, March, and April.

Most areas of this unit are used for irrigated crops and for hay and pasture. A few areas are used for urban development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil, wetness, and long periods of flooding in years of abnormally high precipitation.

Intensive management is required to reduce the salinity and maintain soil productivity. The amount of salts present, the degree of stratification, the crops planted, and the reclamation procedures used affect the yield of crops on the unit. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Tile drainage can be used if a suitable outlet is available. The risk of flooding is reduced by the use of levees, canals, and diversions.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the moderate permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface and damage the crops.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil and wetness. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness. Proper drainage and irrigation water management reduce the concentration of salts. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

Irrigation water can be applied by the furrow and border methods. Leveling helps to insure the uniform application of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for urban development are wetness, the saline-alkali condition of the soil, and long periods of flooding in years of abnormally high precipitation.

Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The moderate permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption line helps to compensate for these limitations.

The risk of flooding is reduced by the use of levees, canals, and diversions.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

169—Vaquero and Altamont clays, 15 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly annual grasses and forbs. Elevation is 1,250 to 3,000 feet. The average annual precipitation is 12 to 18 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 200 to 240 days.

Included in this unit are small areas of Altamont clay and Vaquero clay that have slopes of as much as 75 percent, Henneke very gravelly clay loam, Sagaser loam, and Wadesprings stony loam. Also included are small areas of Gaviota loam, Millsholm clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

The Vaquero soil is moderately deep and well drained. It formed in residuum derived dominantly from shale. Typically, the surface layer is yellowish brown and brown clay about 17 inches thick. The underlying material to a depth of 36 inches is brown, brownish yellow, and yellowish brown clay. Brown, yellowish brown, brownish yellow, and gray, highly fractured shale is at a depth of 36 inches. This soil is alkali below a depth of 17 inches.

Permeability of the Vaquero soil is slow. The water intake rate is high, however, when the soil is dry and the cracks are open. As the soil becomes wet and the cracks close, the intake rate greatly decreases. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Altamont soil is deep and well drained. It formed in residuum derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown clay about 31 inches thick. The underlying material to a depth of 55 inches is yellowish brown clay. Pale yellow and strong brown sandstone is at a depth of 55 inches.

Permeability of the Altamont soil is slow. The water intake rate is high; however, as the soil becomes wet and the cracks close, the intake rate greatly decreases. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is well suited to use as rangeland. The production of forage is limited by landslides on the steeper slopes.

This unit is difficult to fence. Excessive shrinking and swelling of the soils cause fenceposts to be lifted out of the ground.

Livestock grazing should be managed to protect the unit from erosion. Grazing should be delayed until the soils are firm and the more desirable forage plants have had an opportunity to set seed. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly wild oat, soft chess, red brome, filaree, burclover, and remnant perennial grasses.

This unit is poorly suited to nonirrigated crops. It is limited mainly by steepness of slope, the hazard of water erosion, landslides on the steeper slopes, effective rooting depth, and slow permeability. Erosion is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Crop residue left on or near the surface conserves moisture, maintains tilth, and controls erosion.

If this unit is used for homesite development, the main limitations are high potential for shrinking and swelling, restricted depth to bedrock, steepness of slope, slow permeability, and susceptibility to landslides.

If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation. Cuts needed to provide essentially level building sites can expose bedrock. The risk of erosion is increased if the soils are left exposed during site development.

Cutbanks are not stable and are subject to slumping. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load.

Structures to divert runoff are needed if buildings and roads are constructed. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability subclass VIe (15), nonirrigated.

170—Vaquero and Altamont clays, 50 to 75 percent slopes. This map unit is on mountains. The native vegetation is mainly annual grasses and forbs. Elevation is 1,300 to 2,900 feet. The average annual precipitation is 12 to 18 inches, the average annual air

temperature is 59 to 62 degrees F, and the average frost-free period is 200 to 240 days.

Included in this unit are small areas of Altamont clay and Vaquero clay that have slopes of as little as 30 percent, Gaviota loam, and Millsholm clay loam. Also included are small areas of Kreyenhagen loam, Sagaser loam, Wadesprings stony loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

The Vaquero soil is moderately deep and well drained. It formed in residuum derived dominantly from shale. Typically, the surface layer is yellowish brown and brown clay about 17 inches thick. The underlying material to a depth of 36 inches is brown, brownish yellow, and yellowish brown clay. Brown, yellowish brown, brownish yellow, and gray, highly fractured shale is at a depth of 36 inches. This soil is alkali below a depth of 17 inches.

Permeability of the Vaquero soil is slow. The water intake rate is high; however, the intake rate greatly decreases when the soil becomes wet and the cracks close. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Altamont soil is deep and well drained. It formed in residuum derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown clay about 31 inches thick. The underlying material to a depth of 55 inches is yellowish brown clay. Pale yellow and strong brown sandstone is at a depth of 55 inches.

Permeability of the Altamont soil is slow. The water intake rate is high; however, the intake rate greatly decreases as the soil becomes wet and the cracks close. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by landslides. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is difficult to fence. Excessive shrinking and swelling of the soils cause fenceposts to be lifted out of the ground.

Livestock grazing should be managed to protect the unit from erosion. Grazing should be delayed until the soils are firm and the more desirable forage plants have had an opportunity to set seed. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly wild oat, soft chess, red brome, filaree, burclover, and remnant perennial grasses.

This map unit is in capability subclass VIIe (15), nonirrigated.

171—Vaquero-Altamont-Millsholm complex, 15 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly annual grasses and forbs. Elevation is 1,700 to 2,500 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 59 to 62 degrees F, and the average frost-free period is 210 to 240 days.

This unit is 35 percent Vaquero clay, 30 percent Altamont clay, and 25 percent Millsholm clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Altamont clay, Millsholm clay loam, and Vaquero clay that have slopes of as much as 75 percent, Gaviota loam, and Rock outcrop. Included areas make up about 10 percent of the total acreage.

The Vaquero soil is moderately deep and well drained. It formed in residuum derived dominantly from shale. Typically, the surface layer is yellowish brown and brown clay about 17 inches thick. The underlying material to a depth of 36 inches is brown, brownish yellow, and yellowish brown clay. Brown, yellowish brown, brownish yellow, and gray, highly fractured shale is at a depth of 36 inches. This soil is alkali below a depth of 17 inches.

Permeability of the Vaquero soil is slow. The water intake rate is high; however, the intake rate greatly decreases as the soil becomes wet and the cracks close. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Altamont soil is deep and well drained. It formed in residuum derived dominantly from sandstone or shale. Typically, the surface layer is grayish brown and dark grayish brown clay about 31 inches thick. The underlying material to a depth of 55 inches is yellowish brown clay. Pale yellow and strong brown sandstone is at a depth of 55 inches.

Permeability of the Altamont soil is slow. The water intake rate is high; however, the intake rate greatly decreases as the soil becomes wet and the cracks close. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Millsholm soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is yellowish brown clay loam about 4 inches thick. The subsoil is yellowish brown clay loam about 13 inches thick. Light yellowish brown sandstone is at a depth of 17 inches. In some areas the surface layer is loam.

Permeability of the Millsholm soil is moderate. Available water capacity is very low to low. Effective

rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is well suited to use as rangeland. The production of forage is limited by landslides on the steeper slopes of the Vaquero and Altamont soils and by the effective rooting depth and very low to low available water capacity of the Millsholm soil.

This unit is difficult to fence. Excessive shrinking and swelling of the Vaquero and Altamont soils cause fenceposts to be lifted out of the ground.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the unit from erosion. Leaving sufficient plant cover on the soils helps to control erosion and encourages the production of forage. Grazing should be delayed until the soils are firm and the more desirable forage plants have had an opportunity to set seed. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly wild oat, soft chess, ripgut brome, red brome, and filaree.

This unit is poorly suited to nonirrigated crops. It is limited mainly by steepness of slope, landslides on the steeper slopes of the Vaquero and Altamont soils, the effective rooting depth and very low to low available water capacity of the Millsholm soil, and the hazard of water erosion. Erosion is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Crop residue left on or near the surface conserves moisture, maintains tilth, and controls erosion.

If this unit is used for homesite development, the main limitations are steepness of slope, high potential for shrinking and swelling, slow permeability, landslides on the Vaquero and Altamont soils, and limited depth to bedrock in the Millsholm soil. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. The effects of shrinking and swelling can also be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from septic tank absorption fields can surface in downslope areas and thus create a hazard to health. The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation. Cuts needed to provide essentially level building sites can expose bedrock.

Cutbanks are not stable and are subject to slumping. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. Buildings and roads should be designed to offset the limited ability of the soils in this unit to support a load.

Structures to divert runoff are needed if buildings and roads are constructed. The risk of erosion is increased if the soils are left exposed during site development. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability subclass VIe (15), nonirrigated.

172—Wadesprings stony loam, 15 to 50 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived from serpentine, talc, and asbestos. The native vegetation is mainly annual grasses, forbs, and trees. Elevation is 1,400 to 2,500 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 59 to 61 degrees F, and the average frost-free period is 200 to 240 days.

Typically, the surface layer is gray stony loam about 1 inch thick. The upper 17 inches of the subsoil is gray clay loam, and the lower 13 inches is gray cobbly clay loam. Light bluish gray, gray, and yellow, fractured talc and asbestos and cobbles of serpentine are at a depth of 31 inches.

Included in this unit are small areas of Altamont clay, Henneke very gravelly clay loam, and Kreyenhagen loam and Wade loam that have slopes of as much as 75 percent. Also included are small areas of Gaviota loam, Millsholm clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Wadesprings soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is well suited to use as rangeland. Proper grazing use is essential. Livestock grazing should be managed to protect the unit from erosion. Leaving sufficient plant cover on the surface helps to control erosion and encourages the production of forage. Emergency seeding with adapted grasses or other plants following fire helps to stabilize the soil and to control soil erosion. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The unfavorable calcium-to-magnesium ratio, which is characteristic of soils that formed in material derived from serpentine, is not present in this soil, possibly because lime occurs with the serpentine.

The characteristic plant community on this unit is mainly wild oat, soft chess, and blue oak.

This unit is poorly suited to homesite development. The main limitations are shallow depth to bedrock and steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

Cuts needed to provide essentially level building sites can expose bedrock. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. Structures to divert runoff are needed if buildings and roads are constructed.

Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass VIe (15), nonirrigated.

173—Wadesprings stony loam, 50 to 75 percent slopes. This moderately deep, well drained soil is on mountains. It formed in residuum derived from serpentine, talc, and asbestos. The native vegetation is mainly annual grasses, forbs, and trees. Elevation is 1,500 to 3,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 59 to 61 degrees F, and the average frost-free period is 200 to 240 days.

Typically, the surface layer is gray stony loam about 1 inch thick. The upper 17 inches of the subsoil is gray clay loam, and the lower 13 inches is gray cobbly clay loam. Light bluish gray, gray, and yellow, fractured talc and asbestos and cobbles of serpentine are at a depth of 31 inches.

Included in this unit are small areas of Altamont clay, Vaquero clay, and Henneke very gravelly clay loam and Wadesprings stony loam that have slopes of as little as 30 percent. Also included are small areas of Gaviota loam, Millsholm clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Wadesprings soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland, watershed, and wildlife habitat.

This unit is poorly suited to use as rangeland. The production of forage is limited by the hazard of water erosion. Slope limits access by livestock and results in overgrazing of the less sloping areas.

The unfavorable calcium-to-magnesium ratio, which is characteristic of soils that formed in material derived from serpentine, is not present in this soil, possibly because lime occurs with the serpentine.

Proper grazing use is essential on this unit. Livestock grazing should be managed to protect the soil from erosion. Leaving sufficient plant cover on the unit helps to control erosion and encourages the production of forage. Emergency seeding with adapted grasses or other plants following fire helps to stabilize the soil and to control soil erosion. Correct placement of salt and supplemental feed helps to distribute livestock grazing and prevent overgrazing. Watering troughs and tanks should be provided for livestock because of the limited supply of water.

The characteristic plant community on this unit is mainly wild oat, soft chess, and blue oak.

This map unit is in capability subclass VIIe (15), nonirrigated.

174—Wasco sandy loam, 0 to 5 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sandstone. Elevation is 225 to 1,000 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 63 to 65 degrees F, and the average frost-free period is 250 to 265 days.

Typically, the surface layer is grayish brown coarse sandy loam about 1 inch thick. The upper 19 inches of the underlying material is light brownish gray sandy loam, and the lower part to a depth of 60 inches or more is light olive brown sandy loam. This soil is calcareous below a depth of 20 inches.

Included in this unit are small areas of a Cantua coarse sandy loam and a Kettleman loam that have slopes of as much as 10 percent, a Kimberlina fine sandy loam that has a sandy substratum, and Panoche loam. Also included are small areas of Avenal loam, Cajon sandy loam, eroded soils that have a gravelly sandy loam substratum, and soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Wasco soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for nonirrigated grain crops. It is also used for irrigated crops if irrigation water is available and for urban development.

This unit is well suited to irrigated crops. It is limited mainly by the moderate hazard of erosion and the low to moderate available water capacity.

This unit is not considered suitable for nonirrigated crops. Nonirrigated crops are limited mainly by a lack of sufficient rainfall to bring grain crops to maturity. In most years nonirrigated barley is used for grazing sheep; however, in rare years of above normal precipitation, it may be harvested.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Applications of irrigation water should be

adjusted to the available water capacity, the water intake rate, and the crop needs to avoid overirrigating and leaching of plant nutrients. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion.

Maintaining crop residue on or near the surface reduces runoff, reduces erosion, and helps to maintain soil tilth and organic matter content. Tillage should be kept to a minimum. Soil blowing is reduced by planting crops in alternate strips and at right angle to the prevailing wind.

Seeding early in fall, stubble-mulch tillage, and construction of terraces, diversions, and grassed waterways can be used to control erosion. Grassed waterways are needed in areas where overflow from intermittent streams empties onto the cultivated soil. Drop structures should be installed in grassed waterways where needed.

This unit is suited to urban development. The main limitation is the moderate hazard of erosion. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. Structures to divert runoff are needed if buildings and roads are constructed.

This map unit is in capability unit IIe-4 (17), irrigated, and capability subclass VIIe (17), nonirrigated.

175—Westcamp loam, partially drained. This very deep, somewhat poorly drained, saline-alkali soil is on basin rims and flood plains. It formed in alluvium derived dominantly from sedimentary and igneous rock. Slope is 0 to 2 percent. Elevation is 190 to 220 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 260 to 275 days.

Typically, the surface layer is light brownish gray loam and silt loam about 10 inches thick. The underlying material to a depth of 72 inches is stratified, light yellowish brown, pale yellow, light gray, and very pale brown silt loam, silty clay, and clay. Mottles are in most layers below a depth of 10 inches. The soil is calcareous and saline-alkali throughout. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Armona loam, Boggs sandy loam, Houser clay, and Lakeside loam that have been partially drained. Also included are small areas of a Grangeville sandy loam that is saline-alkali, Houser fine sandy loam and Rambla loamy sand that have been drained, and soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Westcamp soil is very slow. Available water capacity is low to high because the salinity of the soil differs from one to another. Effective rooting depth of the crops commonly grown in the area is limited by a perched water table that is at a depth of 48 to 72 inches. This soil is considered to be partially drained because of the presence of dams and reservoirs in the Sierra Nevada, pumping from the water table, and the use of drainage canals. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to very long periods of flooding late in winter and early in spring.

Most areas of this unit are used for irrigated crops. A few areas are used for hay and pasture and for homesite development.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited by the saline-alkali condition of the soil, wetness, the hazard of flooding, the stratified profile, and very slow permeability.

The amount of salts present, the degree of stratification, the crops planted, and the reclamation procedures used affect the yield of crops on this unit. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Tile drainage can be used if a suitable outlet is available. The risk of flooding is reduced by the use of levees, canals, and diversions.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

Furrow, border, and sprinkler irrigation systems are suited to this unit. Because of the very slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water. The application of water should be regulated so that water does not stand on the surface and damage the crops.

If this unit is used for hay and pasture, the main limitations are the saline-alkali condition of the soil, wetness, the hazard of flooding, the stratified substratum, and the very slow permeability. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Salt-tolerant species are most suitable for planting. Leaching the salts from the surface layer is limited by wetness; however, drainage and irrigation water management reduce the concentration of salts. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer. Use of nitrogen and phosphorus promotes good growth of forage plants.

The risk of flooding is reduced by the use of levees, canals, and diversions. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to

keep the pasture in good condition and to protect the soil from erosion.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are wetness, the saline-alkali condition of the soil, the hazard of flooding, and the very slow permeability. Deep drainage reduces wetness. Tile drainage can be used if a suitable outlet is available. Plants that tolerate wetness and droughtiness should be selected if irrigation and additional drainage are not provided.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used.

The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The risk of flooding is reduced by the use of levees, canals, and diversions.

The very slow permeability and wetness increase the possibility of failure of septic tank absorption fields. Use of sandy backfill for the trench and long absorption lines helps to compensate for these limitations.

This map unit is in capability unit IIIw-6 (17), irrigated, and capability subclass VIIw (17), nonirrigated.

176—Westhaven loam, 0 to 2 percent slopes. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Elevation is 210 to 310 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 62 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is light brownish gray loam about 7 inches thick. The upper 38 inches of the underlying material is stratified, light brownish gray silt loam and silty clay loam, the next 27 inches is light brownish gray silty clay, and the lower part to a depth of 84 inches is light gray loamy sand. Mottles are in some layers below a depth of 24 inches. This soil is calcareous to a depth of 72 inches. In some areas the surface layer is sandy loam.

Included in this unit are small areas of a Kimberlina fine sandy loam that has a sandy substratum, Panoche loam, Twisselman silty clay, Wasco sandy loam, and Westhaven clay loam that is saline-alkali. Also included are small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Westhaven soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly almonds, alfalfa, barley, cotton, and wheat. Among the other crops grown are lettuce, melons, tomatoes, and grapes. Some areas are used for homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the stratified substratum that restricts permeability and drainage.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Before planting orchards, the soil should be trenched along the rows and backfilled with suitable soil material to increase permeability and improve drainage. Growing cover crops in nontilled fruit or nut orchards increases the water intake rate and helps to control dust. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitation is the moderately slow permeability, which can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to overcome this limitation.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability class I (17), irrigated, and capability subclass VIIc (17), nonirrigated.

177—Westhaven loam, 2 to 5 percent slopes. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from sedimentary rock. Elevation is 200 to 275 feet. The average annual precipitation is 6 to 7 inches, the average annual air temperature is 64 to 65 degrees F, and the average frost-free period is 255 to 265 days.

Typically, the surface layer is light brownish gray loam about 7 inches thick. The upper 38 inches of the underlying material is stratified, light brownish gray silt loam and silty clay loam, the next 27 inches is light brownish gray silty clay, and the lower part to a depth of 84 inches is light gray loamy sand. Mottles are in some layers below a depth of 24 inches. This soil is calcareous to a depth of 72 inches. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Cantua coarse sandy loam and Kettleman loam that have slopes of as much as 10 percent; Excelsior sandy loam; Kimberlina

fine sandy loam that has a sandy substratum; Westcamp loam that has been partially drained; and Westhaven loam that has slopes of less than 2 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Westhaven soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for irrigated crops, mainly almonds, alfalfa, barley, cotton, and wheat. A few areas are used for homesite development.

This unit is suited to irrigated crops. It is limited mainly by the hazard of erosion and the stratified substratum that restricts permeability and drainage.

Sprinkler irrigation is a suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. If a furrow irrigation system is used, runs should be on the contour or across the slope.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Before planting orchards, this soil should be trenched along the rows and backfilled with suitable soil material to increase permeability and improve drainage. Growing cover crops in nontilled fruit or nut orchards increases the water intake rate, reduces runoff and erosion, and helps to control dust. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for homesite development, the main limitations are the moderately slow permeability and the hazard of erosion. The moderately slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The risk of erosion is increased if the soil is left exposed during site development. Structures to divert runoff are needed if buildings and roads are constructed.

This map unit is in capability unit IIe-1 (17), irrigated, and capability subclass VIIe (17), nonirrigated.

178—Westhaven clay loam, saline-alkali, 0 to 2 percent slopes. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Elevation is 200 to 265 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 62 to 65 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is light brownish gray clay loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified, light brownish gray, light gray, and pale olive clay, fine sandy loam, and silty clay loam. Mottles are in some layers below a depth of 32 inches. The soil is calcareous throughout. It is saline-alkali in some parts. In some areas the surface layer is clay.

Included in this unit are small areas of Excelsior sandy loam, Lethent clay loam, Westcamp loam that has been partially drained, and Westhaven loam. Also included are small areas of Kimberlina fine sandy loam, Panoche clay loam, and Twisselman silty clay that are saline-alkali and small areas of soils that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Westhaven soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly alfalfa, barley, cotton, and safflower. A few areas are used for homesite development.

This unit is best suited to crops that are salt- and alkali-tolerant. It is limited mainly by the saline-alkali condition of the soil and slow permeability.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water and the application of water should be regulated so that water does not stand on the surface and damage the crops. Subsoiling improves the water intake rate and allows salts to be leached downward.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

Population growth has resulted in increased construction of homes on this unit. The main limitations for homesite development are the saline-alkali condition of the soil and slow permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning plant residue to the soil. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

The slow permeability can cause septic tank absorption fields to fail. Use of sandy backfill for the trench and long absorption lines helps to compensate for this limitation.

This map unit is in capability unit IIs-6 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

179—Whitewolf coarse sandy loam. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 200 to 300 feet. The average annual precipitation is 7 to 8 inches, the average annual air temperature is 63 to 64 degrees F, and the average frost-free period is about 255 to 265 days.

Typically, the surface layer is grayish brown coarse sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is white sand. In some areas the surface layer is loamy sand.

Included in this unit are small areas of Cajon sandy loam, Kimberlina fine sandy loam that has a sandy substratum in some areas and is saline-alkali in some areas, and Wasco sandy loam. Also included are small areas of soils, near the Kings River, that are subject to rare periods of flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Whitewolf soil is moderately rapid to a depth of 10 inches and rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more, but the roots are mainly in the upper 8 to 15 inches of the soil. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for irrigated crops, mainly alfalfa, barley, corn, cotton, and wheat. Among the other crops grown are grapes and other fruits and nuts. Some areas are used for urban development.

If this unit is used for irrigated crops, the main limitations are low available water capacity, moderately rapid and rapid permeability, and the long and narrow shape of mapped areas. Before planting orchards or vineyards, the soil should be trenched along the rows and backfilled with suitable soil material to increase the effective rooting depth.

Sprinkler irrigation is a suitable method of applying water. The low available water capacity and the moderately rapid and rapid permeability of the soil can be compensated for by irrigating areas of this soil more frequently than the surrounding soils. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. All crops respond to phosphorus; most crops except legumes respond to nitrogen.

If this unit is used for urban development, the main limitations are rapid permeability below the surface layer and droughtiness.

If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite sewage disposal systems.

Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens.

This map unit is in capability unit IIIs-4 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

180—Youd fine sandy loam. This shallow, somewhat poorly drained, saline-alkali soil is on flood plains. It formed in alluvium derived dominantly from igneous and sedimentary rock. Slope is 0 to 1 percent. Elevation is 250 to 290 feet. The average annual precipitation is 7 to 8 inches, the average air temperature is 62 to 63 degrees F, and the average frost-free period is 250 to 275 days.

Typically, the surface layer is pale yellow fine sandy loam about 10 inches thick. The next layer to a depth of 26 inches or more is a pale yellow hardpan. The upper 8 inches of the underlying material is pale yellow very fine sandy loam, and the lower part to a depth of 60 inches or more is light gray sand. Mottles are in most layers below a depth of 10 inches. The soil is calcareous to a depth of 26 inches. It is saline-alkali in some parts. In some areas the surface layer is loam.

Included in this unit are small areas of Excelsior sandy loam, Melga silt loam, and Remnoy very fine sandy loam. Also included are small areas of Kimberlina fine sandy loam and Nord fine sandy loam that are saline-alkali, soils that are more than 20 inches deep to a hardpan, and Youd fine sandy loam that is not subject to flooding. Included areas make up about 15 percent of the total acreage.

Permeability of this Youd soil is moderately slow in the upper part and very slow in the hardpan. Available water capacity is very low to moderate because the salinity of the soil differs from one area to another. Effective rooting depth is 8 to 20 inches. Runoff is very slow, and the hazard of water erosion is slight. This soil is subject to brief periods of flooding late in winter and early in spring.

This unit is used for irrigated crops.

This unit is best suited to irrigated crops that are salt- and alkali-tolerant. It is limited mainly by the hardpan, the saline-alkali condition of the soil, very low to moderate available water capacity, and brief periods of flooding (fig. 9). Ripping and shattering the hardpan increases the effective rooting depth and improves internal drainage.

If this unit is irrigated, salinity influences the choice of crops. Intensive management is required to reduce the salinity and maintain soil productivity. The content of toxic salts is reduced by leaching, applying proper

Figure 9.—Cottonfield in an area of Youd fine sandy loam. Barren areas occur as a result of the hardpan and the content of salts and alkali in the soil.

amounts of soil amendments, and returning crop residue to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Permeability and available water capacity increase if the hardpan is ripped and the saline-alkali condition is significantly reduced by reclamation. The amount of salts present, the crops planted, and the reclamation procedures used affect the yield of crops on this unit.

A cropping system that includes crop rotation and return of crop residue to the soil or regular addition of other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crops respond to nitrogen and phosphorus.

The risk of flooding is reduced by the use of levees, canals, and diversions. Furrow, border, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Because of the moderately slow permeability of the soil, the length of runs should be adjusted to permit adequate infiltration of water.

If this unit is used for hay and pasture, the main limitations are the hardpan, the saline-alkali condition of the soil, and very low to moderate available water capacity. Ripping and shattering the hardpan increases the effective rooting depth and improves internal drainage. The concentration of salts and alkali limits the production of some hay and pasture plants. The content of toxic salts is reduced by leaching, applying proper amounts of soil amendments, and returning crop residue

to the soil. Gypsum, sulfur, and sulfuric acid are among the soil amendments that can be used to reclaim the soil in this unit. If sulfur or sulfuric acid is used, lime should be present in the surface layer.

Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus promotes good growth of forage plants.

If this unit is used for homesite development, the main limitations are the hardpan, moderately slow permeability, the saline-alkali condition of the soil, and brief periods of flooding. The hardpan is rippable and therefore is not a serious limitation for most engineering uses.

The restricted permeability can cause septic tank absorption fields to fail. This limitation can be overcome by increasing the size of the absorption field. The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability.

The saline-alkali condition of the soil causes high corrosivity to steel and concrete. Treated steel pipe and sulfate-resistant concrete should be used. Selection of salt- and alkali-tolerant plants is important for the establishment of lawns, shrubs, trees, and vegetable gardens. Among the practices that can be used to reclaim the soil are applying gypsum and adequately leaching the salts. The risk of flooding is reduced by the use of levees, canals, and diversions. The risk of erosion is increased if the soil is left exposed during site development. Revegetation of disturbed areas as soon as possible reduces the risk of erosion.

This map unit is in capability unit IVs-8 (17), irrigated, and capability subclass VIIs (17), nonirrigated.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in this survey area are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, seed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal units of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope is no more than 5 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 166,502 acres, or nearly 19 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The following map units meet the soil requirements for prime farmland when irrigated. On some soils included in the list, measures have been used to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The soils in unit 149 are prime farmland if the saturation extract is less than 4 millimhos per centimeter, reaction is less than 8.4, and the exchangeable sodium percentage is less than 15. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

102 Avenal loam, 0 to 5 percent slopes
108 Corona silt loam
120 Grangeville fine sandy loam, partially drained
131 Kimberlina fine sandy loam, sandy substratum
144 Milham sandy loam, silty substratum
147 Nord fine sandy loam
149 Nord complex
150 Panoche loam
165 Twisselman silty clay
174 Wasco sandy loam, 0 to 5 percent slopes
176 Westhaven loam, 0 to 2 percent slopes
177 Westhaven loam, 2 to 5 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

By Ray Foote, soil conservationist, and Clarence U. Finch, conservation agronomist, Soil Conservation Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service and the Storie index ratings used by the University of California, Agricultural Experiment Station, are explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In the following paragraphs, the main management practices for the soils in the survey that are suitable for crops and pasture are briefly discussed. The major concerns when farming the soils are maintaining and improving their production capacity and controlling erosion. Needed management practices include conservation cropping systems, using crop residue, proper tillage, irrigation water management, using cover crops, erosion control, removing excess water, pasture management, and chiseling and subsoiling.

Soil improvement practices that can be used in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. They also include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Many different cropping systems are used in the survey area. A typical 6-year cropping sequence is cotton, barley or sorghum grain, and hay. The residue of these crops should be returned to the soil, and minimum tillage should be used.

Soil compaction is a hazard in this survey area. Tillage destroys the structure of the soil, reduces the organic matter content, and commonly creates a plowpan below the depth of tillage. Tillage increases the risk of erosion, and the plowpan limits permeability and restricts the penetration of roots. The length of time required for the plowpan to develop can be increased by varying the depth of tillage. Combining tillage operations to reduce the number of trips over the field and delaying tillage when the soils are wet also help to prevent compaction and to maintain soil tilth. Chiseling to a shallow depth helps to break up the pan once it has formed.

Irrigation water management is needed to control the rate, amount, and timing of applications of irrigation water. Furrow, border, sprinkler, and drip irrigation are

used in this survey area. Furrow and border irrigation are suitable where slopes are 2 percent or less. Sprinkler irrigation is suited to all the tillable soils in the survey area. Drip irrigation is used in this survey area mainly on orchards and vineyards. Irrigation water should be applied at a rate and in amounts needed to meet the requirements of the crop grown and the characteristics of the soils without excess runoff or deep percolation. Additional irrigation water is needed on the saline-alkali soils in order to meet their leaching requirements.

Cover crops should be grown in orchards and vineyards and in other areas where the soils are left fallow during the rainy season. Cover crops provide protection from erosion and help to maintain or improve the penetration of water, tilth, and fertility. The main cover crops in the survey area are volunteer native plants. If a seeded cover crop is needed or desired, grasses such as barley, brome, ryegrass, or annual fescue can be seeded alone. If a legume cover crop is used, plants such as clover, vetch, or birdsfoot trefoil can be seeded alone. Cover crops can be managed by mowing or disking. If a continuous cover is desired, the cover crop should be mowed or disked after the annual grass or legume seed crop has matured.

Many different practices can be used to control erosion in the survey area. Among these are land leveling or smoothing, selecting the best method of irrigation, and controlling irrigation to reduce erosion of irrigated soils. Other practices that can be used to control erosion are use of crop residue, use of a cover crop in the rotation, minimum tillage, and cross-slope farming. Structures can also be used to control erosion. These include grassed waterways, diversions, grade stabilization structures, water retention structures, or streambank stabilization structures.

Excess surface water, either from rainfall or irrigation, is a concern in some low-lying areas, in swales, or at the lower end of irrigated fields. Excess water results in decreased crop production and can provide a habitat for weeds or mosquitoes. Excess water on the surface can be controlled by properly leveling the land, constructing irrigation tailwater return systems, and properly managing irrigation water. Diversion dikes or canals to divert and control floodwater may be needed in low-lying areas such as the Tulare Basin and areas near major streams.

A perched water table is present in most of the soils in the central part of the survey area. Some areas of these soils may need subsurface drainage systems. Among these soils are those of the Armona, Gepford, Grangeville, Houser, Lakeside, Tulare, and Westcamp series. Subsurface drainage is needed to keep the water below the primary rooting zone of plants and to leach salts from the soil profile. Subsurface drainage can be accomplished by constructing open drainage ditches and installing tile drains or other perforated drainage systems. The poor quality water that is collected by the drainage systems needs to be disposed of by use of proper waste water disposal methods.

Management of irrigated pasture is needed to prevent soil compaction, maintain a desirable plant community, extend the life of the pasture, and provide for maximum production. A suitable pasture management program can include irrigation water management, rotation grazing, fertilization, harrowing or dragging to scatter droppings, and clipping as needed to maintain uniform growth. Grazing should be started when the plants are 8 to 10 inches high, and livestock should be removed when a minimum of 3 to 4 inches of stubble remains.

Selection of a suitable plant mixture when establishing a pasture is important. For most of the soils in the survey area, suitable mixtures contain orchardgrass or tall fescue together with birdsfoot trefoil, strawberry clover, or ladino clover. If proper pasture management is used, these species can produce an abundance of high quality forage.

Chiseling or subsoiling is needed on the soils in the area that have a plowpan or hardpan. Chiseling the plowpan and deep ripping the hardpan will increase the permeability of the soils, improve internal drainage, help to prevent development of a perched water table, and allow roots to penetrate to a greater depth. Chiseling also temporarily benefits the soils that have a clay subsoil; however, the clay subsoil will eventually return to its original condition. The soils in the area that have a hardpan are those of the Melga, Remnoy, and Youd series, which are along Cross Creek, in the northeastern part of the survey area. The depth to which a soil is ripped should be based on the depth of the hardpan in the soil.

The coarse textured soils in the southwestern part of the area are very susceptible to soil blowing. Difficulty may be encountered during land leveling for irrigation and preparation for planting and establishing a crop. In dryfarmed areas, soil blowing often damages the plants by abrasion when they are young. If feasible, cultivation should be done during the months when the possibility of damage from the wind is least. Full use should be made of crop residue, cover crops, and minimum tillage. Ordinarily, the coarse textured soils that are erodible by the wind are too droughty for dryland cultivation; if they are cultivated, however, soil blowing can be partially controlled by leaving stubble and crop residue on the surface, keeping the surface cloddy, and using surface tillage or cultivating in alternate strips. Stripcropping at right angle to the prevailing wind also reduces soil blowing.

The properties of the soils in the survey area strongly influence the kind of pasture plants that can be grown. Where the climate and topography are about the same, the kind of crops that can be grown is related closely to the kind of soil present. The main crops that are suited to the soils in the survey area are fruit and nut crops and field crops.

The fruit and nut crops that are suited to the soils in the survey area include peaches, nectarines, plums, apricots, grapes, walnuts, and almonds. Most of these crops are grown in the north-central and northeastern parts of the area. The ability of a plant to tolerate salts and alkali is an important factor in determining it's adaptability to the soils. Most of the fruit and nut crops in the survey area are not salt and alkali tolerant; therefore, their use generally is limited to the well drained, nonsaline-nonalkali soils such as those of the Nord, Panoche, and Wasco series.

The field crops suited to the soils in the survey area where water is available for irrigation include cotton, tomatoes, alfalfa, barley, wheat, corn, safflower, grain sorghum, sugar beets, and pasture. All of these field crops can be grown on any of the irrigated soils in the area; however, the fine textured soils in the Tulare Lake Basin are best suited to cotton, barley, safflower, and wheat. The saline-alkali soils in the area, such as the Armona, Excelsior, Garces, Grangeville, Lakeside, Lethent, and Panoche soils, are best suited to alfalfa, corn, grain sorghum, sugar beets, tomatoes, and pasture.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*17*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States,

shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Storie Index Rating

By Gordon L. Huntington, lecturer and soil specialist, Department of Land, Air, and Water Resources, University of California, Davis.

The soils in the survey area are rated in table 6 according to the Storie index (*13, 14*). This index expresses numerically the relative degree of suitability of a soil for general intensive agricultural use as it exists at the time of evaluation. The rating is based on soil characteristics only and is obtained by evaluating factors such as soil depth, surface soil texture, subsoil characteristics, drainage, salts and alkali, and relief. Other factors, such as availability of water for irrigation, climate, and distance to markets, that might determine the desirability of growing certain plants in a given locality are not considered. Therefore, in itself, the index should not be used as a direct indicator of land value. However, where economic factors are known to the user, the Storie index provides additional objective information for land tract value comparisons.

Four general factors are used in determining the index rating; *A*, the permeability of the soil profile and soil depth; *B*, the texture of the surface soil; *C*, the dominant slope of the soil body; and *X*, other factors more readily subject to management or modification. In this survey area the X factors include drainage, hazard of flooding, nutrient level, and salts and alkali. For some soils more than one of the X factors are used in rating. Each of the four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable, or ideal condition for general crop production. Lower percentage ratings are selected from data and observations that relate soil properties to plant growth and crop yield. Factor ratings are selected from tables prepared from data and observations that relate soil properties to plant growth and crop yield. In the tables currently used, certain soil properties are allowed ranges of values to conform with variations of the properties in relation to their effect on the suitability of the soil for general agricultural purposes; for example, soil depth or proportion of gravel present in a gravelly loam surface soil. The modal condition of a soil property, as it is described in a soil map unit, is used to select a value for rating when a range of tabular values exists.

The index rating for a soil is obtained by multiplying the rating values given to its four factors, A, B, C, and X. If more than one X factor exists for a soil, the values for the additional factor, or factors, act as additional multipliers. Thus, any factor may dominate or control the final rating. For example, consider a soil such as Grangeville fine sandy loam, saline-alkali, partially drained (*12*). It is a deep soil with a moderately permeable profile. This warrants a rating of 100 for factor A. It has a fine sandy loam surface soil texture, warranting a rating of 100 for factor B. The smooth, nearly level surface of the soil justifies a rating of 100 for factor C. However, it has a perched water table at a depth of 4 to 6 feet, warranting a value of 80, and is saline-alkali affected, warranting a value of 60. Multiplied together, this produces a rating of 48 for factor X. Multiplying A, B, C, and X gives a Storie index of 46 for this soil. If, in time, the water table can be lowered and the saline-alkali condition improved, the Storie index can be increased by assigning appropriate higher values to the X factors to reflect the changed conditions.

Soil complexes in the survey area, such as Kettleman-Cantua complex, 30 to 50 percent slopes, are rated to reflect the proportion of the dominant soils described in the unit. Each of the dominant soils in such complexes is rated separately and the values shown in table 6. The single index value for each complex is a weighted average. This does not apply to soil-Rock outcrop complexes. In soil associations (for example, Vaquero and Altamont clays, 15 to 50 percent slopes) the dominant soils are rated separately and respectively in accordance with the map unit name. The rockiness of the unit is rated in factor B. Pits, Dumps, Rock outcrop, or Urban land are not evaluated in terms of the factors A, B, C, or X. They have features that are very severely limiting for agricultural use of any kind. As such, they are assigned an index value of less than 10.

Soils are placed in grades according to their suitability for general intensive agriculture as shown by their Storie index ratings. The six grades and their range in index ratings are:

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

In this area, soils in *Grade 1* are well suited to intensive use for irrigated crops that are climatically adapted to the region. *Grade 2* soils are good agricultural soils, although they are not so desirable as soils in Grade 1 because of coarser surface or subsoil

textures, a somewhat less permeable subsoil, or moderate soil depth, gentle to moderate slopes, or slight accumulations of salts and alkali. *Grade 3* soils are only fairly well suited to agriculture and are limited in their use because of moderate to steep slopes, moderate soil depth, a less permeable subsoil, clayey surface soil texture, poor drainage, or accumulations of salts and alkali. *Grade 4* soils are poorly suited. They are severely limited in their agricultural potential because of shallower depth, steeper slopes, more salts and alkali, flooding, or poorer drainage than for soils in Grade 3. *Grade 5* soils are very poorly suited to agriculture. *Grade 6* consists of soils and miscellaneous areas that are not suited at all because of very severe to extreme limitations with regard to the aforementioned properties, including, in some cases, strong saline or alkali conditions. Table 6 lists the grade for each soil in this area.

Rangeland

Prepared by Franklyn E. Archuleta, range conservationist, Soil Conservation Service.

About 20 percent of the survey area is rangeland. Commercial cow-calf and stocker operations are dominant in the southwestern part of the area. Sheep operations generally are concentrated in the drier, lower lying areas in the southern part. The average ranch is 12,000 acres.

In fall and late in summer, forage commonly is supplemented by hay or protein concentrate. The period when green feed is adequate usually starts about February and lasts until about May. Livestock generally are then taken to feedlots.

The properties of the soils strongly influence the kind of natural vegetation that grows. In the southwestern part of the area, most of the soils are loam and clay loam and are moderately deep over shale and sandstone. These soils mainly support annual grasses and forbs. Total production is moderate on south-facing slopes because of the low available water capacity and restricted rooting depth. In much of the western part of the area, the soils are serpentinitic and production is low because of the adverse calcium- to magnesium-ratio. Also in this part of the area are clayey soils that are subject to slippage in years of above-average rainfall. These soils are the most productive in the survey area.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community.

Proper grazing use is grazing at an intensity that maintains enough cover to protect the soil and maintains or improves the quality and quantity of desirable vegetation. It is necessary to allow a part of the desirable species to set seed if they are to be maintained in the plant community, and it is necessary to control grazing if a desirable plant community is to be maintained. If grazing is not controlled, only the unpalatable species will be allowed to reproduce. Leaving the dry vegetation on the rangeland at the beginning of fall and during winter helps to promote the growth of green forage. A desirable amount of stubble

left at the end of the grazing season allows for faster establishment and better winter growth of new seedlings. The stubble protects the new plants from drying winds and sun. The decomposing plant material partially intermixed with the soil conserves moisture and promotes establishment and early growth of each year's seedlings (*4*).

The amount of residue left should be between 700 and 1,000 pounds of air-dry vegetation per acre in areas that have slopes of less than 30 percent and between 1,000 and 1,200 pounds per acre in areas that have slopes of more than 30 percent. Determination of the amount of residue to be left should be done just prior to the beginning of the rainy season, normally about November 1.

Proper season of use is based on the characteristics of the plant community. It means grazing only during seasons when the range is best adapted for grazing. In this survey area three seasons are recognized. The dry forage season is from about June through October. Some of the current year's growth should be left to conserve soil moisture, to protect the soil from erosion, and to provide humus for soil fertility. The inadequate green feed season is usually between November and January. Most of the plant growth occurs during short rainy periods; supplemental feeding is necessary during the dry periods. The adequate green feed season lasts from about February through May. Enough forage is available to feed the livestock during the grazing season and to leave enough of the current year's growth of desirable forage plants to provide protection of the plants and to encourage growth the following year. Spring grazing should be delayed until the desirable forage species are ready for grazing and the soil conditions are such that no damage will occur as a result of equipment use.

Distribution of livestock grazing involves all the practices that can be used to encourage livestock to spread out and graze the forage in an area as uniformly as possible. The objectives are to minimize overuse and wasted forage and maximize proper use. Grazing efficiency varies because of differences in water and shale distribution, topography, kinds of forage available, type of livestock, and season of use. The use of salt in obtaining uniform grazing is important. Salt should be placed wherever grazing is desired; however, it should be placed next to watering facilities.

In the areas grazed by sheep, it generally is practical to haul water. This results in improved grazing distribution. Open herding of sheep is an effective means of distributing grazing pressure and reducing the incidence of plant poisoning. Close herding keeps the animals bunched up so that forage is trampled. A one night bedding system should be used. Continued bedding in the same area results in severe trampling of the vegetation and compaction of the soil. This restricts the rate of water absorption by the soil and promotes erosion.

Cattle are not ordinarily herded on a range; however, in rough or poorly watered areas a rider is beneficial to guide cattle movements. Calf crops are increased by keeping bulls and cows properly distributed. Grazing units are more efficiently used by pushing cattle from bottom land areas to underused, steeper areas (*11*).

Proper distribution of livestock watering developments, wherever economically or physically feasible, helps to distribute grazing pressure. If animals are required to travel long distances to and from water, weight gain and distribution are greatly reduced. It also encourages overgrazing of forage in areas adjacent to watering areas. The number of watering areas needed depends on the kind of livestock, climate, and topography.

Proper location of livestock trails and walkways is effective in distributing grazing. In steep, rocky places and in areas of dense brush, establishment of livestock trails helps to provide access to forage.

A *planned grazing system* is a harvest procedure in which two or more grazing units are alternately rested from grazing in a planned sequence over a period of years. The period of rest can be throughout the year or during the growing season of desirable plants. A system may be designed to help achieve several objectives—the composition of the plant community can be maintained or improved, the supply of forage can be better stabilized throughout the grazing season, and watershed and wildlife habitat can be protected. The system is designed to help meet the objectives of individual range managers.

When management of vegetation does not achieve the objectives within a reasonable length of time, one or more supplemental practices may be applied to help meet the objectives more quickly. Use of these practices commonly results in dramatic changes in the plant community. If protective measures are not taken, livestock tend to overgraze areas where these practices have been applied. These practices include rangeland seeding, brush management, and fencing. Cross-fencing and fertilization of rangeland soils in the survey area generally are not economically feasible.

Range seeding helps to improve existing rangeland by establishing forage plants and increasing production, or it can be used to convert cropland to rangeland. Seeding improves the natural beauty of rangeland and reduces soil erosion.

Brush management can be used to reduce competition from woody plants and to help establish or reestablish a desirable grass cover to limit soil and water losses, thus increasing forage production and controlling runoff. Brush management also improves the habitat for some species of wildlife, improves recreation sites, and enhances esthetic value.

The objective in range management is to control grazing to provide for adequate residue to protect the

soil from erosion and insure that plants produced are palatable and nutritious. Such management generally results in the maximum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a plant community somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Technical assistance in planning rangeland management can be obtained from local offices of the Soil Conservation Service or from the Kings County Resource Conservation Districts.

Recreation

Demand for recreational facilities in the survey area will increase as population and leisure time increases. Private recreational facilities can be developed as a supplemental enterprise to farming or ranching. The hills and mountains west of Reef Ridge and Kreyenhagen Hills have good potential for the development of such private recreational facilities as hunting and fishing clubs, campgrounds, guest ranches, and fishout pond operations for catfish, bass, and sunfish. The Kings River furnishes good opportunities for fishing, boating, and swimming. The California Aqueduct also provides good fishing opportunities. In addition, the survey area has several golf courses and community parks.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 10 and interpretations for septic tank absorption fields in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By Larry H. Norris, biologist, Soil Conservation Service.

Wildlife and fish are important resources. Fish and wildlife improve the quality of the environment, act as early indicators of pollution, and provide numerous opportunities for recreation. Wildlife-related activities such as nature studying, bird watching, hunting, and fishing have an effect on the area's economy. Many types of wildlife help in the natural control of weeds, insects, and animal pests.

Warm water fish, including largemouth bass, smallmouth bass, black crappie, catfish, and sunfish, inhabit the rivers and ponds of the area. The rivers and creeks also provide important riparian habitat for mammals, birds, reptiles, and insects. In the intensively farmed areas, these riparian corridors commonly are the only wildlife habitat available.

The Tulare Lake Basin, in the center of Kings County, is an important ancestral wintering area for ducks and shore birds. The irrigation of approximately 20,000 to 25,000 acres of barley in August, September, and October makes the lake extremely valuable to early migrating waterfowl. Every year approximately 250,000 waterfowl use these areas.

Man's activities have varied effects on the wildlife population. Many species, such as sparrows, blackbirds, and ground squirrels, can tolerate man's activities and actually thrive in close association with man. In contrast, the existence of some species has been threatened by man and his activities.

Three rare or endangered wildlife species are in the survey area (*6*). The rare San Joaquin kit fox is primarily in areas of the San Joaquin Valley floor and foothills that are under native vegetation. Because valley areas suited to agriculture are being converted to irrigated cropland, the kit fox is confined to areas unsuited to agriculture and to rolling foothills and canyons. The populations of the endangered bluntnosed leopard lizard and the California condor are on the decline because of the loss of natural habitat.

The soils in this survey area on the Diablo Range have poor or fair potential as rangeland wildlife habitat. The main limitations are the low available water capacity of the Henneke, Millsholm, and Gaviota soils and the high shrink-swell potential of the Vaquero and Altamont soils. These limitations restrict the growth of shrubs that provide food and cover for rangeland wildlife. Management of wildlife habitat on these soils consists mainly of maintaining the existing habitat. Watering facilities such as small ponds and guzzlers improve the habitat.

The soils on the Kettleman and Kreyenhagen Hills have very poor or poor potential as rangeland wildlife habitat. The main limitation is the arid climate. The soils are wet 90 consecutive days or less in winter, and they receive 7 inches of rainfall or less annually. This greatly limits the diversity and production of wild herbaceous plants and shrubs that provide food and cover for rangeland wildlife. In areas where the parent material is soft or highly fractured, such as in the Kettleman soils, the land can be managed and improved for shrub growth. In other areas management for wildlife consists primarily of maintaining the existing vegetation. Watering facilities such as small ponds and guzzlers improve the habitat for wildlife if a plant cover is established nearby.

The soils on alluvial fans on the west side of the San Joaquin Valley are rated poor or very poor for their potential as openland and rangeland habitat. The main limitation is the arid climate. The soils are wet 90 consecutive days or less in winter, and they receive 7 inches of rainfall or less annually. This greatly limits the availability of drinking water and the diversity and production of wild herbaceous plants and shrubs that provide food and cover for wildlife. Water developments such as irrigation systems, small ponds, and guzzlers can improve habitat for rangeland and openland wildlife. If managed properly, crops can provide food and seasonal cover for wildlife and irrigation can provide water. Vegetated odd areas, irrigation ditches, and drainage ditches provide year-round hiding, resting, and nesting areas for openland wildlife.

The saline-alkali soils on lower alluvial fans and basin rims in the San Joaquin Valley have poor or very poor potential as rangeland and openland habitat. The main limitations are the arid climate and saline-alkali condition of the soils. These limitations greatly limit the availability of drinking water and the diversity and production of wild herbaceous plants and shrubs that provide food and cover for wildlife. Water developments such as irrigation systems, small ponds, and guzzlers along with the establishment of permanent vegetation can improve the habitat. If sufficient quantities of water are available, these soils can easily be developed for use as wetland habitat.

The soils in basins and on lower alluvial fans, alluvial plains, flood plains, and basin rims have very poor potential as openland wildlife habitat. These soils are saline-alkali and have a high perched water table. The high content of salt and alkali in these soils limits the diversity and production of wild herbaceous plants and shrubs that provide food and cover. Water developments such as irrigation systems produce only fair results when a permanent cover of highly saline-alkali tolerant plants is established. These soils have fair potential as wetland wildlife habitat if sufficient water is available. The main limitation is the saline-alkali condition of the soils.

All of the soils on alluvial fans and flood plains in the middle of the San Joaquin Valley except the Nord soils have very poor potential as openland wildlife habitat. The main limitations are the shallow depth, the arid climate, and the saline-alkali condition of the soils. Water developments such as irrigation systems produce poor or fair results in improving openland habitat if used along with the establishment of a permanent cover of salt- and alkali-tolerant plants.

With the exception of the Nord and Kimberlina soils, these soils have good or fair potential as wetland wildlife habitat if sufficient water is available. The Nord and Kimberlina soils have poor potential because of drainage and permeability.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and

distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, vetch, wheatgrass, and wild oats.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are chamise, manzanita, black sage, and saltbush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wild rice, saltgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include California valley quail, pheasant, meadow lark, field sparrow, cottontail, and coyote.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, and muskrat.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include California mule deer, red-tailed hawk, meadowlark, and horned lark.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet.

Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic

matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter. If floodwater will not enter the lagoon and floods are of low velocity and less than 3 feet deep, the flooding hazard may be disregarded.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are

difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic

matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (*1*) and the Unified soil classification system (*2*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection of the soil.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption yields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeters in size. These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that

delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A *thin* pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A *thick* pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*18*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, available water, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy over clayey, mixed (calcareous), thermic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional body of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*16*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*18*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Altamont Series

The Altamont series consists of deep, well drained soils on hills and mountains. These soils formed in residuum derived dominantly from sandstone or shale. Slope ranges from 15 to 75 percent.

Soils of the Altamont series are fine, montmorillonitic, thermic Typic Chromoxererts.

Typical pedon of an Altamont clay in an area of Vaquero and Altamont clays, 15 to 50 percent slopes; about 40 feet southeast of the dirt road; in the SW1/4NW1/4SW1/4 of sec. 26, T. 23 S., R. 16 E.

A11—0 to 3 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 3/3) moist; strong medium angular blocky structure parting to strong thick platy; very hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; slightly acid; abrupt wavy boundary.

A12—3 to 11 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium angular blocky structure; very hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; common intersecting slickensides; neutral; clear wavy boundary.

A13—11 to 31 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong very coarse angular blocky structure; very hard, very firm, sticky and very plastic; many very fine roots; common very fine tubular pores; common intersecting slickensides; neutral; clear wavy boundary.

C1ca—31 to 55 inches; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; lime is segregated and in common fine soft masses; slightly effervescent; moderately alkaline; clear wavy boundary.

C2r—55 inches; variegated pale yellow (2.5Y 7/4) and strong brown (7.5YR 5/6) highly weathered and fractured sandstone; lime is between fractures in many fine filaments and seams; strongly effervescent.

Depth to paralithic contact of shale or sandstone is 40 to 60 inches or more. Vertical cracks close in November or December and remain closed until April or May, but they are open the rest of the year.

The C horizon has dry color of 10YR 5/4 or 5/2 or of 2.5Y 6/2, and it has moist color of 10YR 4/3 or 4/2 or of 2.5Y 4/2. Reaction is mildly alkaline or moderately alkaline.

Armona Series

The Armona series consists of very deep, poorly drained, saline-alkali soils on basin rims and flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Armona series are fine-loamy, mixed (calcareous), thermic Fluvaquentic Haplaquolls.

Typical pedon of Armona loam, partially drained; about 0.75 mile south of the city of Stratford, about 200 feet north of the Tulare Lake Canal and 300 feet west of 20 1/2 Avenue; in the SW1/4NW1/4NE1/4 of sec. 20, T. 20 S., R. 20 E.

Ap—0 to 9 inches; dark gray (5Y 4/1) loam, black (5Y 2/1) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores and common very fine tubular pores; electrical conductivity is 3.0 millimhos per cubic centimeter; exchangeable sodium percentage is 2; mildly alkaline; abrupt smooth boundary.

A12cssa—9 to 14 inches; gray (5Y 5/1) loam, very dark gray (5Y 3/1) moist; common fine prominent yellowish brown (10YR 5/4) mottles, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; very hard, friable, slightly sticky and plastic; many very fine roots; many very fine interstitial pores and common very fine tubular pores; common fine gypsum crystals; disseminated lime; electrical conductivity is 13.5 millimhos per centimeter; exchangeable sodium percentage is 20; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1gcssa—14 to 19 inches; gray (5Y 5/1) loam, dark gray (5Y 4/1) moist; common fine prominent strong brown (7.5YR 5/6) mottles, dark reddish brown (5YR 3/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; common fine gypsum crystals; disseminated lime; electrical conductivity is 18 millimhos per centimeter; exchangeable sodium percentage is 26; slightly effervescent; moderately alkaline; abrupt wavy boundary.

IIC2gsa—19 to 22 inches; gray (5Y 5/1) sandy loam, dark gray (5Y 4/1) moist; common fine prominent strong brown (7.5YR 5/6) mottles, dark reddish brown (5YR 2.5/2) and reddish brown (5YR 4/4) moist; massive; very hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; disseminated lime; electrical conductivity is 16 millimhos per centimeter; exchangeable sodium percentage is 32; slightly effervescent; moderately alkaline; abrupt wavy boundary.

IIC3gsa—22 to 25 inches; light gray (5Y 7/2) sandy loam, olive gray (5Y 5/2) moist; common fine prominent yellowish brown (10YR 5/4) mottles, dark brown (7.5YR 4/4) moist; massive; very hard, very friable, nonsticky and nonplastic; many very fine interstitial pores and common very fine tubular pores; disseminated lime; electrical conductivity is 19 millimhos per centimeter; exchangeable sodium percentage is 30; slightly effervescent; mildly alkaline; abrupt wavy boundary.

IIIC4gcssa—25 to 30 inches; gray (5Y 5/1) clay loam, dark gray (5Y 4/1) moist; common fine prominent reddish yellow (7.5YR 6/6) and common fine faint dark gray (5Y 4/1) mottles, dark brown (7.5YR 4/4) and black (5Y 2.5/1) moist; massive; very hard, friable, sticky and very plastic; many very fine and fine interstitial pores and common very fine tubular pores; common fine gypsum crystals; disseminated

lime; electrical conductivity is 20 millimhos per centimeter; exchangeable sodium percentage is 30; slightly effervescent; mildly alkaline; clear smooth boundary.

IVAgcssab—30 to 36 inches; olive gray (5Y 5/2) loam, dark olive gray (5Y 3/2) moist; common fine prominent dark yellowish brown (10YR 4/4) and common fine faint dark gray (5Y 4/1) mottles, dark reddish brown (5YR 3/2) and black (5Y 2.5/1) moist; massive; very hard, friable, sticky and very plastic; many very fine and fine interstitial pores and common very fine tubular pores; common fine gypsum crystals; disseminated lime; electrical conductivity is 18 millimhos per centimeter; exchangeable sodium percentage is 28; slightly effervescent; mildly alkaline; abrupt smooth boundary.

VC5gsa—36 to 41 inches; olive gray (5Y 5/2) silt loam, olive gray (5Y 4/2) moist; common fine distinct very dark gray (5Y 3/1, moist) mottles; massive; very hard, friable, sticky and plastic; many very fine interstitial pores and common very fine tubular pores; disseminated lime; electrical conductivity is 17 millimhos per centimeter; exchangeable sodium percentage is 27; slightly effervescent; mildly alkaline; abrupt smooth boundary.

VIC6gsa—41 to 60 inches; light gray (5Y 7/1) sand, gray (5Y 6/1) moist; common fine prominent dark brown (7.5YR 4/4) mottles; dark reddish brown (5YR 3/2) moist; massive; hard, loose; many very fine interstitial pores and few very fine tubular pores; electrical conductivity is 21 millimhos per centimeter; exchangeable sodium percentage is 21; moderately alkaline.

The profile is saturated in some or all parts most of the year. Organic matter content is 1 to 2 percent in the A horizon and decreases irregularly with increasing depth. The profile is slightly saline-alkali to strongly saline-alkali. Depth to lime is 4 to 10 inches.

The A horizon has dry color of 10YR 4/1 or 5/1, of 2.5Y 5/2, or of 5Y 4/1 or 5/1, and it has moist color of 10YR 3/1 or 3/2, of 2.5Y 3/2, or of 5Y 2/1, 2/2, 3/1, or 3/2. Moist mottles are faint to prominent and have color of 5YR 3/4 or 5Y 7/2. Reaction is mildly alkaline to strongly alkaline.

The C horizon has dry color of 2.5Y 5/2, 6/2, or 7/2 or of 5Y 5/1, 5/2, 6/2, 6/3, 7/1, or 7/2, and it has moist color of 2/5Y 3/2 or 4/2 or of 5Y 4/1, 4/2, 5/2, 5/3, 6/1, or 6/2. Moist mottles are faint to prominent and have color of 5YR 2.5/2, 3/2, 4/4, or 5/8, of 7.5YR 4/4, 5/4, or 5/6, of 10YR 5/6, of 2.5Y 3/0, 4/2, or 4/4, or of 5Y 2.5/1, 3/1, 3/2, or 4/1. This horizon commonly is loam or clay loam, but the 10- to 40-inch control section has thin horizons that range from sand to clay. The weighted average clay content is 20 to 35 percent. Durinodes range from 0 to 15 percent in the part of the C horizon below a depth of 40 inches. The C horizon is mildly alkaline to very strongly alkaline.

Avenal Series

The Avenal series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from sedimentary rock. Slope ranges from 0 to 5 percent.

Soils of the Avenal series are fine-loamy, mixed, thermic Typic Haplargids.

Typical pedon of Avenal loam, 0 to 5 percent slopes; about 1 1/4 miles northwest of Highway 41 and 25 feet west of the Navy Pipeline on the east side of Sunflower Valley; 400 feet west and 330 feet north of the center of sec. 2, T. 24 S., R. 17 E.

A11—0 to 2 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate thin platy; slightly hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; neutral; abrupt smooth boundary.

A12—2 to 8 inches; brown (10YR 5/3) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine and few fine tubular pores; mildly alkaline; abrupt smooth boundary.

B2t—8 to 24 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; many moderately thick clay films on peds; disseminated lime; slightly effervescent; mildly alkaline; abrupt smooth boundary.

B3t—24 to 36 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; many moderately thick clay films on peds; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Cca—36 to 61 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; many very fine interstitial pores; lime is disseminated and in common fine seams and few medium firm masses; violently effervescent; moderately alkaline.

The part of the profile at a depth of 4 to 12 inches is dry in all parts from mid-April to mid-January. The soil temperature is more than 47 degrees F at all times. The profile is not continuously moist in some part for 90 consecutive days. It is noneffervescent in the A horizon

and increases in effervescence with increasing depth. The profile is 25 to 35 percent sand and 35 to 45 percent silt.

The A horizon has dry color of 10YR 5/3 or 6/3 or of 2.5Y 4/2, 5/2, or 6/2, and it has moist color of 10YR 3/2 or 4/2 or of 2.5Y 3/2 or 4/2.

The B2t horizon has dry color of 10YR 5/3 or 6/3 or of 2.5Y 5/2, 5/4, or 6/2, and it has moist color of 10YR 4/3 or 2.5Y 4/2. It is 27 to 35 percent clay.

The C horizon has dry color of 10YR 6/4 or 7/4 or of 2.5Y 5/2 or 4/4, and it has moist color of 2.5Y 4/2, 4/4, or 5/4. It is loam or clay loam.

Boggs Series

The Boggs series consists of very deep, somewhat poorly drained, saline-alkali soils on alluvial plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Boggs series are coarse-loamy, mixed, thermic Typic Salorthids.

Typical pedon of Boggs sandy loam, partially drained; about 3.5 miles southwest of the city of Lemoore, about 435 feet east of 20th Avenue and 990 feet south of Jackson Avenue; in the SW1/4NW1/4NW1/4 of sec. 28, T. 19 S., R. 20 E.

A11sa—0 to 3 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; electrical conductivity is 32 millimhos per centimeter; exchangeable sodium percentage is 62; mildly alkaline; abrupt smooth boundary.

A12sa—3 to 6 inches; grayish brown (2.5Y 5/2) coarse sandy loam, very dark grayish brown (2.5Y 3/2) moist; white (10YR 8/2) salt crystals; single grain; soft, loose, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores; electrical conductivity is 220 millimhos per centimeter; exchangeable sodium percentage is 95; moderately alkaline; abrupt smooth boundary.

A13saca—6 to 15 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; single grain; soft, loose, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; disseminated lime; electrical conductivity is 70 millimhos per centimeter; exchangeable sodium percentage is 65; violently effervescent; strongly alkaline; clear wavy boundary.

C1saca—15 to 30 inches; light olive gray (5Y 6/2) sandy loam, olive (5Y 5/3) moist; massive; soft, friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores and few very fine tubular pores; lime in common fine irregularly shaped filaments; electrical conductivity is 75 millimhos per centimeter; exchangeable sodium percentage is 62; violently effervescent; strongly alkaline; abrupt smooth boundary.

C2saca—30 to 33 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; common medium distinct light yellowish brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; massive; soft, friable, nonsticky and nonplastic; common very fine and few fine and medium roots; many very fine interstitial pores and common very fine tubular pores; disseminated lime; electrical conductivity is 120 millimhos per centimeter; exchangeable sodium percentage is 59; strongly effervescent; strongly alkaline; abrupt smooth boundary.

C3saca—33 to 38 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and few fine and medium roots; few very fine interstitial pores and common very fine tubular pores; disseminated lime; electrical conductivity is 120 millimhos per centimeter; exchangeable sodium percentage is 58; strongly effervescent; strongly alkaline; abrupt smooth boundary.

IIA1sab—38 to 46 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; strong medium subangular blocky structure; very hard, very firm, sticky and plastic; common very fine and few fine and medium roots; common very fine tubular pores; disseminated lime; electrical conductivity is 80 millimhos per centimeter; exchangeable sodium percentage is 57; slightly effervescent; moderately alkaline; abrupt smooth boundary.

IIC4saca—46 to 52 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; disseminated lime; electrical conductivity is 70 millimhos per centimeter; exchangeable sodium percentage is 63; violently effervescent; strongly alkaline; clear wavy boundary.

IIIC5saca—52 to 60 inches; light olive gray (5Y 6/2) sandy loam, olive gray (5Y 5/2) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few very fine interstitial pores; lime in many fine irregularly shaped soft masses; electrical conductivity is 70 millimhos per centimeter; exchangeable sodium percentage is 64; violently effervescent; strongly alkaline.

The control section is moist all year in most years and is saturated from December to March in some years. Organic matter content is 0.1 to 0.6 percent in the A horizon and decreases irregularly with increasing depth. Most horizons have 2.0 to 8.4 percent soluble salts in native and partially reclaimed pedons.

The A horizon has dry color of 2.5Y 5/2, 6/2, or 7/2 or of 5Y 5/1, 5/2, or 6/2, and it has moist color of 2.5Y 3/2 or 4/2 or of 5Y 4/1 or 4/2. This horizon is mildly alkaline to very strongly alkaline. It is noneffervescent to moderately effervescent.

The C horizon has dry color of 2.5Y 6/2 or 7/2 or of 5Y 6/2, and it has moist color of 2.5Y 4/2 or 5/2 or of 5Y 5/3. Moist mottles are faint to prominent and have color of 10YR 4/6, 2.5Y 5/4 or 6/4, 5Y 4/2, N 5/0, or 5B 6/1. It is sandy loam, fine sandy loam, or (less commonly) coarse sandy loam. Buried horizons, where present, are thin and range from sand to clay. The lower part of the C horizon has 0 to 10 percent durinodes. This horizon is moderately alkaline to very strongly alkaline.

Cajon Series

The Cajon series consists of very deep, somewhat excessively drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Cajon series are mixed, thermic Typic Torripsamments.

Typical pedon of Cajon sandy loam; about 50 feet west of Lakeside Ditch and 1,000 feet south of Houston Avenue; 1,640 feet north and 50 feet west of the center of sec. 7, T. 19 S., R. 22 E.

Ap—0 to 11 inches; pale brown (10YR 6/3) sandy loam, about (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; mildly alkaline; abrupt smooth boundary.

C1—11 to 60 inches; pale brown (10YR 6/3) loamy sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; moderately alkaline; abrupt smooth boundary.

IIC2—60 to 70 inches; light brownish gray (10YR 6/2) sand, brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; many very fine interstitial pores; mildly alkaline.

The part of the profile between depths of 10 and 30 inches is dry from mid-March to mid-December and is not continuously moist for 90 days in winter.

The A horizon has dry color of 2.5Y 6/2 or of 10YR 6/2 or 6/3, and it has moist color of 2.5Y 4/2 or of 10YR 4/2 or 4/3.

The C horizon has dry color of 2.5Y 6/2 or of 10YR 6/2 or 6/3, and it has moist color of 2.5Y 4/2 or of 10YR 4/2, 4/3, 4/4, 3/2, or 3/3. It is mildly alkaline or moderately alkaline.

Cajon soils in this survey area do not contain lime and therefore are outside the range for the series. This difference, however, does not significantly affect their use and management.

Cantua Series

The Cantua series consists of deep, somewhat excessively drained soils on hills. These soils formed in residuum derived dominantly from sandstone. Slope ranges from 5 to 50 percent.

Soils of the Cantua series are coarse-loamy, mixed, nonacid, thermic Typic Torriorthents.

Typical pedon of Cantua coarse sandy loam, 15 to 30 percent slopes; in Kettleman Hills, about 2.25 miles east of the intersection of Highways 41 and 33; in the SW1/4 NE1/4SE1/4 of sec. 27, T. 23 S., R. 18 E.

A1—0 to 1 inch; grayish brown (2.5Y 5/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate thin platy structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine interstitial pores and many fine tubular pores; slightly acid; abrupt smooth boundary.

C1—1 to 55 inches; light brownish gray (2.5Y 6/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many fine interstitial pores and common fine tubular pores; neutral; abrupt wavy boundary.

C2r—55 inches; light brownish gray (2.5Y 6/2), soft, calcareous sandstone.

Depth to weathered sandstone is 40 to 60 inches or more. The part of the profile between depths of 8 and 24 inches is dry from mid-March to January. The profile is moist in some or all parts for 60 to 80 consecutive days.

The A horizon has dry color of 2.5Y 5/2 or 6/4 or of 10YR 6/3, and it has moist color of 2.5Y 4/2 or 10YR 4/3. This horizon commonly is platy, but in some pedons it is massive. It is slightly acid or neutral.

The C horizon has dry color of 2.5Y 6/2 or 6/4, and it has moist color of 2.5Y 4/2 or 4/4 or of 10YR 4/2 or 4/3. It is neutral or mildly alkaline.

Carollo Series

The Carollo series consists of moderately deep, well drained, saline-alkali soils on hills.These soils formed in residuum derived dominantly from shale. Slope ranges from 5 to 20 percent.

Soils of the Carollo series are fine, montmorillonitic, thermic Typic Natrargids.

Typical pedon of Carollo clay loam, 5 to 20 percent slopes; about 2 miles north of the Kern County line, about 480 feet east of 25th Avenue and 90 feet north of fence line; in the SE1/4SW1/4SE1/4 of sec. 22, T. 24 S., R. 19 E.

A1sa—0 to 2 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; strong medium subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine roots; common very fine

tubular pores and common very fine interstitial pores; common fine gypsum crystals; electrical conductivity is 18 millimhos per centimeter; exchangeable sodium percentage is 28; neutral; abrupt smooth boundary.

B21tcssa—2 to 6 inches; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; strong medium columnar structure parting to strong coarse subangular blocky; very hard, firm, sticky and very plastic; many very fine roots; common very fine tubular pores and common very fine interstitial pores; few moderately thick clay films in pores and on peds; common fine gypsum crystals; electrical conductivity is 38 millimhos per centimeter; exchangeable sodium percentage is 38; mildly alkaline; abrupt wavy boundary.

B22tcssa—6 to 11 inches; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; strong coarse subangular blocky structure; extremely hard, firm, sticky and very plastic; few very fine roots; few very fine tubular pores and common very fine interstitial pores; few moderately thick clay films in pores and on peds; many fine gypsum crystals; electrical conductivity is 40 millimhos per centimeter; exchangeable sodium percentage is 40; mildly alkaline; abrupt smooth boundary.

B23tcssa—11 to 19 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; weak medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few very fine interstitial pores; many thick clay films on peds; common fine gypsum crystals; a 0.5 inch layer of clear gypsum overlies the C horizon; electrical conductivity is 40 millimhos per centimeter; exchangeable sodium percentage is 40; neutral; abrupt wavy boundary.

C1cssa—19 to 32 inches; variegated olive gray (5Y 5/2) and very dark gray (N 3/0) clay loam, olive gray (5Y 4/2) and very dark gray (N 3/0) moist; common fine prominent yellowish brown (10YR 5/8, dry or moist) mottles; massive; slightly hard, very friable, sticky and plastic; common very fine interstitial pores; common fine gypsum crystals; electrical conductivity is 45 millimhos per centimeter; exchangeable sodium percentage is 42; neutral; abrupt wavy boundary.

C2r—32 inches; variegated light olive gray (5Y 6/2) and very dark gray (N 3/0) highly fractured shale, olive gray (5Y 4/2) and very dark gray (N 3/0) moist; common fine prominent brownish yellow (10YR 6/8) mottles, yellowish brown (10YR 5/8) moist; hard, firm; shale slakes in water.

Depth to paralithic contact is 20 to 40 inches. The moisture control section is dry in all parts from May through December. The profile has very high levels of salinity, and electrical conductivity is 15 to 50 millimhos per centimeter throughout. Salinity commonly increases with depth.

The A horizon has dry color of 10YR 5/2, 5/4, or 6/3, and it has moist color of 10YR 4/2, 4/3, 5/2, or 5/3. This horizon is neutral or mildly alkaline.

The B2t horizon has dry color of 10YR 5/3, 5/4, 6/2, 6/3, or 6/4, and it has moist color of 10YR 4/2, 4/3, 5/2, 5/3, or 5/4. It is clay or silty clay and averages 40 to 60 percent clay. This horizon has accumulations of calcium sulfate in excess of 2 percent. The exchangeable sodium percentage ranges from 15 to 40. Reaction is neutral to moderately alkaline.

The C1 horizon has dry color of 10YR 6/3 or 6/4, of 5Y 5/2, or of N 3/0, and it has moist color of 10YR 5/3 or 5/4, of 5Y 4/2, or of N 3/0. Mottles are not present in all pedons. The layer of clear, highly fractured, crystalline gypsum 1/8 to 1/2 inch thick that overlies the C horizon is not present in all pedons. Reaction is neutral to moderately alkaline.

Corona Series

The Corona series consists of very deep, moderately well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Corona series are fine-loamy, mixed, thermic Pachic Argixerolls.

Typical pedon of Corona silt loam; in an old walnut orchard, about 0.4 mile south of Dover Avenue and 30 feet west of 9th Avenue; in the SE1/4SE1/4NE1/4 of sec. 31, T. 17 S., R. 22 E.

A1p—0 to 7 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; moderate coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine and medium roots; common fine tubular pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt wavy boundary.

A12—7 to 25 inches; grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; common fine distinct dark brown (7.5YR 3/2, moist) mottles; moderate coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular pores; disseminated lime; slightly effervescent; mildly alkaline; abrupt smooth boundary.

B2lt—25 to 34 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; thin clay films in pores and on peds; few rounded manganese concretions 0.5 to 2 millimeters in diameter; lime in common fine seams; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B22t—34 to 42 inches; grayish brown (10YR 5/2) silty clay loam, very dark gray (10YR 3/1) and dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; few thin clay films in pores and on peds; few rounded manganese concretions 0.5 to 2 millimeters in diameter; lime in common fine seams; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B3tca—42 to 55 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; massive; very hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; few thin clay films in pores and on peds; lime in common fine seams; strongly effervescent; mildly alkaline; abrupt smooth boundary.

C1—55 to 64 inches; light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 4/3) moist; massive; very hard, friable, sticky and plastic; many very fine and fine tubular pores; neutral; abrupt smooth boundary.

C2—64 to 76 inches; light yellowish brown (10YR 6/4) sandy loam, dark brown (10YR 3/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; many very fine and fine tubular pores; neutral.

The part of the profile between depths of 6 and 18 inches is usually moist in all parts from January 1 to April 15. It is dry in all parts from July 15 to mid-November. The organic matter content is more than 1 percent to a depth of 25 inches, and it decreases regularly with increasing depth.

The A horizon has dry color of 10YR 5/1, 5/2, or 4/2, and it has moist color of 10YR 3/1 or 3/2.

The B2t horizon has dry color of 10YR 5/1 or 5/2, and it has moist color of 10YR 3/1 or 3/2. It is mildly alkaline or moderately alkaline and is slightly effervescent or strongly effervescent. It is 27 to 35 percent clay.

The C horizon has dry color of 10YR 6/4 or 5/4, and it has moist color of 10YR 3/3, 4/3, or 4/4. It is loam or sandy loam. It is neutral or mildly alkaline.

Delgado Series

The Delgado series consists of shallow, somewhat excessively drained soils on hills. These soils formed in residuum derived dominantly from sandstone or shale. Slope ranges from 5 to 30 percent.

Soils of the Delgado series are loamy, mixed (calcareous), thermic Lithic Torriorthents.

Typical pedon of Delgado sandy loam, 5 to 15 percent slopes; in the Pyramid Hills, about 0.5 mile east of Highway 41 and 1 mile northeast of the Fire Lookout Station; in the SW1/4NW1/4SE1/4 of sec. 6, T. 24 S., R. 18 E.

A1—0 to 1.5 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; neutral; abrupt smooth boundary.

C—1.5 to 10 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt wavy boundary.

R—10 inches; pink (5YR 7/3) hard laminar lime coatings 1 to 2 millimeters thick underlain by white (2.5Y 8/2) relatively unweathered feldspathic calcareous sandstone that does not slake in water; cracks at 4- to 8-inch intervals; cracks are free of soil; no roots in cracks.

Depth to lithic contact ranges from 7 to 20 inches. The profile is dry immediately above the lithic contact from March through January and is not moist for as long as 60 consecutive days in winter. It is 0 to 35 percent rock fragments 2 millimeters to 10 inches in size.

The A horizon has dry color of 2.5Y 6/2 or 7/2, and it has moist color of 2.5Y 4/2 or 5/2. It commonly is massive but has strong medium platy or subangular blocky structure in some pedons. It is neutral to moderately alkaline.

The C horizon has dry color of 2.5Y 6/2, 6/4, or 7/2, and it has moist color of 2.5Y 4/2, 4/4, or 5/2. It is sandy loam or fine sandy loam and is gravelly in some pedons. It commonly is massive but has strong medium subangular blocky structure in some pedons. Lime is disseminated or is in seams.

Excelsior Series

The Excelsior series consists of very deep, well drained, saline-alkali soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Excelsior series are coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents.

Typical pedon of Excelsior sandy loam; about 1,500 feet west of Highway 43 and 250 feet south of Iona Avenue; 1,500 feet west and 250 feet south of the northeast corner of sec. 17, T. 19 S., R. 22 E.

Ap—0 to 8 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; moderately alkaline; abrupt smooth boundary.

C1—8 to 20 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and

nonplastic; common very fine roots; many very fine interstitial pores; disseminated lime; slightly effervescent; strongly alkaline; abrupt smooth boundary.

IIC2—20 to 26 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; disseminated lime; strongly effervescent; strongly alkaline; clear smooth boundary.

IIIC3—26 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and fine tubular pores; disseminated lime; strongly effervescent; very strongly alkaline.

The part of the profile between depths of 8 and 20 inches is dry in all parts from April through December and is not continuously moist for 90 consecutive days. The organic matter content is less than 1 percent at the surface, and it decreases irregularly with increasing depth. The profile typically is saline-alkali in some part.

The A horizon has dry color of 10YR 5/2, 7/2, or 6/2 or of 2.5Y 6/2, and it has moist color of 10YR 5/2 or 4/2 or of 2.5Y 4/2. This horizon ranges from noneffervescent to strongly effervescent. It is moderately alkaline or strongly alkaline.

The C horizon has dry color of 10YR 6/3, 7/2, or 6/2 or of 2.5Y 7/2, 6/2, or 7/4, and it has moist color of 10YR 4/3, 4/2, or 5/2 or of 2.5Y 4/2, 5/2, or 5/4. Few fine distinct mottles with moist color of 10YR 5/6 or 4/4 are present in the lower part of the C horizon in some pedons. This horizon is stratified sandy loam, loamy sand, silt loam, and loam. It ranges from slightly effervescent to strongly effervescent. The lime is disseminated or is in filaments or concretions. The IIIC horizon has exchangeable sodium percentage of 15 to 80.

Garces Series

The Garces series consists of very deep, well drained, saline-alkali soils on alluvial fans. These soils formed in alluvium derived dominantly from granite. Slope ranges from 0 to 2 percent.

Soils of the Garces series are fine-loamy, mixed, thermic Typic Natrargids.

Typical pedon of Garces loam; about 0.3 mile north of Kent Avenue; 1,200 feet south and 500 feet east of the center of sec. 35, T. 19 S., R. 22 E.

A1—0 to 1 inch; gray (10YR 5/1) fine sandy loam, very dark gray (10YR 3/1) moist; moderate thin platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and interstitial pores; neutral; abrupt smooth boundary.

A21—1 to 4 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; strong very thick platy structure; hard, friable, slightly sticky and slightly plastic; many very fine roots concentrated on the upper boundary of the horizon; many very fine tubular and interstitial pores; neutral; abrupt wavy boundary.

A22—4 to 9 inches; light gray (10YR 7/1) loam, dark grayish brown (10YR 4/2) moist; strong very coarse prismatic structure; hard, very friable, sticky and slightly plastic; many very fine roots concentrated on the upper boundary of the horizon; many very fine tubular and interstitial pores; disseminated lime; slightly effervescent; very strongly alkaline; clear wavy boundary.

B2tca—9 to 17 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular and interstitial pores; continuous thick clay films on peds and in pores; lime is disseminated and is segregated in few fine irregularly shaped soft masses; strongly effervescent; very strongly alkaline; clear wavy boundary.

B3tca—17 to 22 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure; hard, firm, sticky and plastic; few very fine roots; many very fine tubular and interstitial pores; many moderately thick clay films on peds and in pores; lime is disseminated and is segregated in many medium irregularly shaped soft masses; violently effervescent; very strongly alkaline; clear wavy boundary.

C1ca—22 to 37 inches; light gray (2.5Y 7/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common very fine tubular pores and many very fine interstitial pores; few thin clay films on peds; lime is disseminated and is segregated in many medium irregularly shaped soft masses; violently effervescent; very strongly alkaline; clear smooth boundary.

C2ca—37 to 46 inches; pale yellow (2.5Y 7/4) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct yellowish brown (10YR 5/8) mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine tubular pores and many very fine interstitial pores; lime is disseminated and is segregated in many medium irregularly shaped soft masses; strongly effervescent; very strongly alkaline; abrupt smooth boundary.

C3ca—46 to 55 inches; light gray (2.5Y 7/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; few fine

distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, very friable, sticky and plastic; few very fine tubular pores and many very fine interstitial pores; lime is disseminated and is segregated in many medium irregularly shaped soft masses; strongly effervescent; very strongly alkaline; abrupt smooth boundary.

C4—55 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; few fine and medium distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine tubular pores and many very fine interstitial pores; disseminated lime; strongly effervescent; very strongly alkaline.

The part of the profile between depths of 4 and 12 inches is dry in all parts from April 1 until January 1 and is moist in some or all parts for only as long as 60 to 90 consecutive days from January through March. Organic matter content is less than 0.5 percent.

The A horizon has dry color of 10YR 5/1, 5/2, 6/2, 7/1, or 7/2 or of 2.5Y 5/2 or 6/2, and it has moist color of 10YR 3/1, 3/2, 4/2, or 5/2 or of 2.5Y 4/2.

The B horizon has dry color of 10YR 5/1, 5/2, 6/3, or 7/2 or of 2.5Y 5/2, and it has moist color of 10YR 3/2, 4/2, 5/2, or 5/3 or of 2.5Y 3/2. It ranges from noneffervescent to violently effervescent. The lime is disseminated or in soft masses. The horizon is moderately alkaline to very strongly alkaline.

The C horizon has dry color of 2.5Y 5/2, 6/2, 7/2, or 7/4 or of 10YR 6/3 or 7/3, and it has moist color of 2.5Y 3/2, 4/2, 5/2, or 5/4 or of 10YR 4/3 or 5/3. Texture ranges from coarse sandy loam to clay loam. The horizon ranges from noneffervescent to violently effervescent. The lime is disseminated or is in soft masses. The horizon is moderately alkaline to very strongly alkaline.

Gaviota Series

The Gaviota series consists of shallow, well drained soils on mountains. These soils formed in residuum derived dominantly from sandstone. Slope ranges from 50 to 75 percent.

Soils of the Gaviota series are loamy, mixed, nonacid, thermic Lithic Xerorthents.

Typical pedon of Gaviota loam, 50 to 75 percent slopes; about 250 feet west of the ranch house; 600 feet south and 350 feet west of the northeast corner of sec. 23, T. 24 S., R. 16 E.

A1—0 to 2 inches; light yellowish brown (10YR 6/4) loam, very dark grayish brown (10YR 3/2) moist; strong medium subangular blocky structure parting to strong fine granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; neutral; abrupt wavy boundary.

C—2 to 12 inches; light yellowish brown (10YR 6/4) loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; neutral; abrupt smooth boundary.

R—12 inches; dark gray (5Y 4/1) highly fractured fine-grained sandstone.

Depth to lithic contact ranges from 10 to 20 inches. The profile becomes moist below a depth of 6 inches in November or December and remains moist all the time in some or all parts below a depth of 6 inches until April or May. The soil temperature is more than 41 degrees F. The profile is less than 1 percent organic matter.

The A horizon has dry color of 10YR 5/4, 6/2, or 6/4, and it has moist color of 10YR 3/2, 4/2, or 4/3.

The C horizon has dry color of 10YR 5/4 or 6/4, and it has moist color of 10YR 3/3, 4/2, or 4/3.

Gepford Series

The Gepford series consists of very deep, poorly drained, saline-alkali soils on flood plains and in basins. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Gepford series are fine, montmorillonitic, thermic Vertic Haplaquolls.

Typical pedon of Gepford clay, partially drained; about 800 feet west of the North Fork Kings River and 60 feet north of Grangeville Boulevard; in the SE1/4SE1/4SW1/4 of sec. 22, T. 18 S., R. 19 E.

A1p—0 to 12 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; few fine distinct pale olive (5Y 6/3) and dark yellowish brown (10YR 4/4) mottles, olive (5Y 5/3) and dark yellowish brown (10YR 4/4) moist; strong very coarse prismatic structure parting to strong coarse and medium angular blocky; hard, very firm, sticky and plastic; many very fine and few fine roots; common very fine tubular pores and many very fine interstitial pores; lime is disseminated and in few fine irregularly shaped soft masses; strongly effervescent; mildly alkaline; abrupt smooth boundary.

A12g—12 to 25 inches; variegated gray (5Y 5/1), dark gray (5Y 4/1), and gray (N 5/0) clay, dark olive gray (5Y3/2), dark gray (5Y 4/1), and black (5Y 2.5/1) moist; common medium distinct greenish gray (5G 6/1) and few fine distinct light olive brown (2.5Y 5/4) mottles, greenish gray (5G 5/1) and light olive brown (2.5Y 5/4) moist; moderate very coarse prismatic structure; cracks 1.5 inches wide to a depth of 19 inches; hard, firm, sticky and very

plastic; many very fine and common fine roots; common very fine tubular pores and many very fine interstitial pores; lime is disseminated and in few irregularly shaped soft masses; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1g—25 to 30 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; many fine faint and distinct very dark gray (5Y 3/1) and olive (5Y 5/4) mottles, black (5Y 2.5/1) and dark yellowish brown (10YR 3/4) moist; massive; hard, firm, very sticky and very plastic; pressure faces; many very fine tubular pores; lime is disseminated and in few fine irregularly shaped soft masses; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2g—30 to 38 inches; light gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; many fine faint pale olive (5Y 6/3) mottles, olive (5Y 4/3) moist; massive; very hard, firm, sticky and very plastic; pressure faces; many very fine tubular pores; lime is disseminated and in few fine irregularly shaped soft masses and common medium very hard nodules; slightly effervescent; moderately alkaline; abrupt smooth boundary.

IIC3g—38 to 54 inches; light olive gray (5Y 6/2) clay loam, gray (5Y 5/1) moist; many fine distinct light yellowish brown (2.5Y 6/4) and few fine distinct brown (7.5YR 5/4) and grayish brown (10YR 5/2) mottles, light olive brown (2.5Y 5/4), dark brown (7.5YR 4/4), and very dark grayish brown (10Y 3/2) moist; massive; very hard, firm, sticky and plastic; pressure faces; many very fine interstitial pores; lime is disseminated and in common medium very hard nodules; slightly effervescent; moderately alkaline; abrupt smooth boundary.

IIIC4g—54 to 60 inches; pale yellow (5Y 7/3) light clay loam, olive (5Y 5/3) moist; few fine distinct light gray (5Y 6/1) and pale yellow (2.5Y 7/4) mottles, gray (5Y 5/1) and light olive brown (2.5Y 5/4) moist; massive; very hard, friable, sticky and plastic; many very fine interstitial pores; lime is disseminated and in common medium very hard nodules; slightly effervescent; moderately alkaline.

The control section is moist in some part all of the time and is saturated for as long as 4 months. Average clay content of the 10- to 40-inch control section is 50 to 60 percent. Organic matter content is 1 to 2 percent in the A horizon, and it decreases irregularly with increasing depth. The solum ranges from 23 to 27 inches in thickness. Calcium carbonate content is 2 to 3 percent in the A horizon and 9 to 15 percent in the lower horizons. Conductivity of the saturation extract ranges from 4 to 16 millimhos per centimeter;.

The A horizon has dry color of 5Y 4/1, 5/1, or 5/2 or of N 5/0, and it has moist color of 5Y 2/1, 2.5/1, 3/1, 3/2, or 4/1 or of N 5/0. Moist values are 3 or less in the upper 11 inches of the horizon.

The C horizon has dry color of 5Y 5/3, 6/1, 6/2, 7/1, 7/3, or 8/1, and it has moist color of 5Y 3/1, 3/2, 4/1, 4/2, 4/3, 5/1, 5/2, or 5/3. Mottles have moist color of 7.5YR 4/4, of 10YR 3/2, 3/4, 3/6, 4/4, or 4/6, of 2.5Y 4/4 or 5/4, of 5Y 2.5/1, 4/3, 4/4, 5/1, 5/3, or 6/3, of 5GY 5/1, of 5G 5/1, or of N 5/0. It is clay or silty clay in the upper part and sand to clay loam in the lower part. It is mildly alkaline or moderately alkaline. Hard lime nodules are few or common.

Goldberg Series

The Goldberg series consists of very deep, somewhat poorly drained, saline-alkali soils on alluvial plains and flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Goldberg series are fine, montmorillonitic, thermic Typic Natraquolls.

Typical pedon of Goldberg loam, partially drained; about 1.6 miles south of Hanford-Armona Road and 1.5 miles west of 19th Avenue; about 825 feet south and 25 feet west of the center of sec. 8, T. 19 S., R. 20 E.

A1—0 to 4 inches; gray (5Y 5/1) loam, very dark gray (5Y 3/1) moist; few fine distinct olive (5Y 4/3, moist) mottles; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; common very fine tubular and interstitial pores; few colloidal stains on peds; electrical conductivity is 1.1 millimhos per centimeter; exchangeable sodium percentage is 4; neutral; clear wavy boundary.

B1t—4 to 16 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; few fine distinct dark gray (5Y 4/1) and olive (5Y 5/3) mottles, black (5Y 2.5/1) and olive (5Y 4/3) moist; moderate coarse angular blocky structure; hard, friable, sticky and plastic; many very fine roots concentrated along vertical faces of peds and common fine roots in peds; common very fine tubular pores and many very fine interstitial pores; common thin clay films on peds and in pores; black (N 2/0) continuous colloidal stains on faces of peds; disseminated lime; electrical conductivity is 5.4 millimhos per centimeter; exchangeable sodium percentage is 7; slightly effervescent; mildly alkaline; abrupt wavy boundary.

B21t—16 to 24 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; few fine distinct olive (5Y 5/3) and dark gray (5Y 4/1) mottles, olive (5Y 4/3) and black (5Y 2.5/1) moist; moderate coarse prismatic structure; hard, friable, sticky and plastic; many very fine roots concentrated along vertical faces of peds and common fine roots in peds; many very fine tubular and interstitial pores; common

moderately thick clay films on peds and in pores; many black (N 2/0) colloidal stains on peds; disseminated lime; few fine gypsum crystals; electrical conductivity is 8.5 millimhos per centimeter; exchangeable sodium percentage is 17; slightly effervescent; moderately alkaline; abrupt wavy boundary.

B22tca—24 to 32 inches; variegated gray (5Y 5/1) and dark gray (5Y 4/1) clay, dark gray (5Y 4/1) moist; few fine distinct olive (5Y 5/3) mottles, olive (5Y 4/3) moist; moderate coarse prismatic structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; few thin clay films on peds and in pores; many pressure faces; many black (N 2/0) colloidal stains on peds; lime is disseminated and in few fine irregularly shaped soft masses; electrical conductivity is 4.5 millimhos per centimeter; exchangeable sodium percentage is 20; slightly effervescent; moderately alkaline; abrupt wavy boundary.

B3tg—32 to 44 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; few fine distinct olive (5Y 5/3) and dark gray (5Y 4/1) mottles, olive (5Y 4/3) and dark greenish gray (5BG 4/1) moist; massive; very hard, friable, sticky and plastic; few very fine roots; few very fine tubular pores; few thin clay films in pores; disseminated lime; electrical conductivity is 2 millimhos per centimeter; exchangeable sodium percentage is 14; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1g—44 to 54 inches; light olive gray (5Y 6/2) clay loam, gray (5Y 5/1) moist; few fine distinct olive (5Y 5/3) and dark gray (5Y 4/1) mottles, olive (5Y 5/3) and dark greenish gray (5BG 4/1) moist; massive; very hard, friable, slightly sticky and plastic; few very fine roots; few very fine interstitial pores; lime is disseminated and in few fine irregularly shaped soft masses; electrical conductivity is 2 millimhos per centimeter; exchangeable sodium percentage is 4; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C2g—54 to 60 inches; light olive gray (5Y 6/2) sandy clay loam, olive gray (5Y 5/2) moist; few fine distinct pale olive (5Y 6/3) and gray (5Y 6/1) mottles, olive (5Y 4/3) and dark greenish gray (5BG 4/1) moist; massive; hard, friable, slightly sticky and plastic; few very fine roots; few very fine tubular and interstitial pores; few black (N 2/0) organic stains in pores; lime is disseminated and in common fine irregularly shaped soft masses; electrical conductivity is 2.1 millimhos per centimeter; exchangeable sodium percentage is 1; strongly effervescent; mildly alkaline.

Unless the soils are artificially drained, the profile is saturated in some or all parts most of the year. Most of the profile is typically saline-alkali. Organic matter content is 1 to 5 percent at the surface. The upper 10 to 15 inches of the profile has moist matrix value of 3 or less.

The A horizon has dry color of 10YR 4/1 or of 5Y 4/1, 4/2, 5/1, 5/2, or 5/3, and it has moist color of 10YR 3/1 or of 5Y 2.5/1, 3/1, or 3/2. Mottles are distinct or prominent and have moist color of 2.5Y 4/2 or 5/6 or of 5Y 4/3 or 4/4. The horizon is neutral to moderately alkaline and is noneffervescent to violently effervescent. It has disseminated lime.

The B2t horizon has dry color of 5Y 4/1, 4/2, 5/1, or 5/2, and it has moist color of 5Y 3/1, 3/2, 4/1, or 4/2. Mottles are distinct or prominent and have moist color of 5Y 2.5/1, 3/1, 3/2, 4/1, 4/2, or 4/3, of 5GY 4/1, of 5G 5/1, or of 5BG 4/1. The horizon is clay loam or clay and is 35 to 50 percent clay. It is mildly alkaline to very strongly alkaline. It is slightly effervescent to violently effervescent. The lime is disseminated or in soft masses. The exchangeable sodium percentage ranges from 12 to 42, but it is 15 or more in the upper part of the horizon.

The C horizon has dry color of 5Y 6/2 or 5/2, and it has moist color of 5Y 4/2, 4/3, 5/1, 5/2, or 5/3. Mottles have moist color of 5Y 4/1, 4/3, 5/3, or 5/6, of 5G 4/1, or of 5BG 4/1. The horizon is loamy sand to clay loam. It is mildly alkaline to very strongly alkaline. It is slightly effervescent to violently effervescent. The lime is disseminated or in soft masses.

Grangeville Series

The Grangeville series consists of very deep, somewhat poorly drained soils on alluvial fans and flood plains. These soils formed in alluvium derived dominantly from igneous rock. Slope ranges from 0 to 1 percent.

Soils of the Grangeville series are coarse-loamy, mixed, thermic Fluvaquentic Haploxerolls.

Typical pedon of Grangeville sandy loam, saline-alkali; about 1,400 feet east of 19th Avenue and 1,240 feet south of Jersey Avenue; about 1,400 feet east and 1,200 feet south of the northwest corner of sec. 34, T. 19 S., R. 20 E.

Ap—0 to 6 inches; dark gray (5Y 4/1) sandy loam, very dark gray (5Y 3/1) moist; strong coarse subangular blocky structure parting to medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores and few very fine and fine tubular pores; disseminated lime; electrical conductivity is 9 millimhos per centimeter; exchangeable sodium percentage is 12; slightly effervescent; neutral; abrupt smooth boundary.

A12—6 to 14 inches; dark gray (5Y 4/1) loam, very dark gray (5Y 3/1) moist; moderate strong subangular blocky structure parting to medium subangular blocky; very hard, firm, sticky and plastic; common very fine roots; common very fine and fine interstitial

pores and common very fine tubular pores; disseminated lime; electrical conductivity is 12 millimhos per centimeter; exchangeable sodium percentage is 17; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C1—14 to 21 inches; olive gray (5Y 5/2) sandy loam, olive gray (5Y 4/2) moist; massive; hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial and tubular pores; disseminated lime; electrical conductivity is 8.5 millimhos per centimeter; exchangeable sodium percentage is 17; slightly effervescent; mildly alkaline; clear wavy boundary.

C2—21 to 35 inches; gray (5Y 5/1) sandy loam, olive gray (5Y 4/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, very friable, slightly sticky and nonplastic; few very fine roots; many very fine interstitial and tubular pores; disseminated lime; electrical conductivity is 7 millimhos per centimeter; exchangeable sodium percentage is 15; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C3—35 to 49 inches; light olive gray (5Y 6/2) fine sandy loam, olive gray (5Y 5/2) moist; common fine distinct dark yellowish brown (10YR 4/6) mottles, dark yellowish brown (10YR 3/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial and tubular pores; disseminated lime; electrical conductivity is 10 millimhos per centimeter; exchangeable sodium percentage is 22; slightly effervescent; mildly alkaline; gradual wavy boundary.

C4—49 to 56 inches; pale olive (5Y 6/3) very fine sandy loam, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine interstitial pores and many very fine tubular pores; electrical conductivity is 9 millimhos per centimeter; exchangeable sodium percentage is 22; mildly alkaline; abrupt smooth boundary.

C5—56 to 63 inches; light olive gray (5Y 6/2) fine sandy loam, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine interstitial pores and common very fine tubular pores; electrical conductivity is 10 millimhos per centimeter; exchangeable sodium percentage is 20; neutral.

The part of the profile between depths of about 8 and 24 inches is continuously dry from May or early in June until November or early in December. In most years the soils are saturated within 25 to 40 inches of the surface from about January to April. The soil temperature is more than 47 degrees F. Organic matter content is 1 to 2 percent in the A horizon, and it decreases irregularly with increasing depth.

The A horizon has dry color of 5Y 4/1 or 4/2 or of 10YR 4/1, 5/1, or 5/2, and it has moist color of 5Y 3/1 or 3/2 or of 10YR 2/1, 3/1, or 3/2. It is neutral to moderately alkaline.

The C horizon has dry color of 5Y 5/1, 5/2, 6/1, 6/2, or 6/3, of 2.5Y 7/2, or of 10YR 6/2, 6/3, 7/2, or 7/3, and it has moist color of 5Y 4/1, 4/2, 5/1, or 5/2, of 2.5Y 4/2 or 5/2, or of 10YR 3/2, 4/2, 5/2, or 5/3. Mottles have moist color of 10YR 3/6, 4/3, or 4/4, of 7.5YR 4/4, of 5YR 3/3, or of 2.5YR 3/6. The horizon is stratified loamy sand to silt loam. Reaction is neutral to strongly alkaline.

Henneke Series

The Henneke series consists of shallow, well drained soils on hills. These soils formed in residuum derived dominantly from serpentine. Slope ranges from 5 to 50 percent.

Soils of the Henneke series are clayey-skeletal, serpentinitic, thermic Lithic Argixerolls.

Typical pedon of Henneke very gravelly clay loam, 15 to 50 percent slopes; in a roadcut in the SE1/4NW1/4NE1/4 of sec. 29, T. 23 S., R. 16 E.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, dark brown (7.5YR 3/2) moist; strong medium subangular blocky structure parting to strong fine granular; hard, friable, sticky and plastic; many very fine roots; many very fine interstitial pores; about 10 percent angular cobbles 3 to 10 inches in size and 35 percent angular pebbles 2 millimeters to 3 inches in size; neutral; abrupt wavy boundary.

B1t—3 to 5 inches; dark brown (7.5YR 3/2) very gravelly clay, dark brown (7.5YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate fine angular blocky; hard, friable, sticky and very plastic; many very fine and common fine roots; many very fine interstitial pores; many thick clay films on peds and in pores; about 10 percent angular cobbles 3 to 10 inches in size and 35 percent angular pebbles 2 millimeters to 3 inches in size; mildly alkaline; clear wavy boundary.

B21t—5 to 10 inches; dark brown (7.5YR 3/2) very gravelly clay, dark brown (7.5YR 3/2) moist; moderate coarse subangular blocky structure parting to moderate fine subangular blocky; hard, friable, very sticky and very plastic; many very fine, common fine, and few medium roots; many very fine interstitial pores; many thick clay films on peds and in pores; about 10 percent angular cobbles 3 to 10 inches in size and 35 percent angular pebbles 2

millimeters to 3 inches in size; neutral; abrupt wavy boundary.

B22t—10 to 18 inches; variegated dark brown (10YR 3/3) and brown (10YR 4/3) very gravelly clay, dark brown (10YR 3/3) and brown (10YR 4/3) moist; weak coarse subangular blocky structure parting to moderate fine subangular; very hard, friable, very sticky and very plastic; common very fine, fine, and medium roots and few coarse roots; many very fine interstitial pores; continuous thick clay films on peds and in pores; about 10 percent angular cobbles 3 to 10 inches in size and 35 percent angular pebbles 2 millimeters to 3 inches in size; neutral; clear wavy boundary.

R—18 inches; variegated pale yellow (2.5Y 8/4), very dark gray (2.5Y 3/0), and white (2.5Y 8/0) serpentine and other metavolcanic rock.

Depth to lithic contact is 10 to 20 inches. The profile is 5 to 15 percent cobbles and 30 to 35 percent gravel. The part of the profile between a depth of about 5 inches and bedrock is usually moist from mid-November through May and is dry the rest of the year. The soil temperature is more than 41 degrees F.

The A horizon has dry color of 10YR 3/2, 4/4, or 5/2, and it has moist color of 7.5YR 3/2 or of 10YR 2/2 or 3/1.

The B horizon has dry color of 7.5YR 3/2 or 4/4 or of 10YR 3/2, 3/3, 4/2, 4/3, or 5/6, and it has moist color of 7.5YR 3/2 or 4/4 or of 10YR 2/2, 3/2, 3/3, 4/3, 4/4, or 5/6. It is very gravelly clay or very gravelly clay loam.

Some pedons have a C1 horizon.

Henneke soils in this survey area have hue of 10YR, which is outside the range for the series. This difference, however, does not significantly affect their use and management.

Homeland Series

The Homeland series consists of very deep, poorly drained, saline-alkali soils on basin rims. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Homeland series are sandy, mixed, thermic Aeric Fluvaquents.

Typical pedon of Homeland fine sandy loam, partially drained; about 1 mile north of Utica Avenue, 1 1/16 miles west of Wilbur Ditch, and 75 feet south of the canal; 400 feet west and 75 feet south of the northeast corner of sec. 11, T. 23 S., R. 20 E.

Ap—0 to 8 inches; light olive gray (5Y 6/2) fine sandy loam, olive gray (5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; common fine vesicular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 29 millimhos per centimeter; exchangeable sodium percentage is 58; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—8 to 12 inches; light gray (5Y 7/2) very fine sandy loam, olive gray (5Y 5/2) moist; many fine distinct white (5Y 8/2) mottles and common fine prominent yellowish brown (10YR 5/8) mottles, pale olive (5Y 6/4) and dark yellowish brown (10YR 4/6) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; many very fine interstitial pores; disseminated lime; electrical conductivity is 18; exchangeable sodium percentage is 61; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2—12 to 15 inches; variegated light gray (5Y 7/2) and pale yellow (5Y 8/4) sandy loam, olive (5Y 5/3) and pale olive (5Y 6/3) moist; few fine prominent yellowish brown (10YR 5/8) mottles, dark yellowish brown (10YR 4/6) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; disseminated lime; electrical conductivity is 5 millimhos per centimeter; exchangeable sodium percentage is 35; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C3—15 to 19 inches; variegated pale yellow (5Y 8/3) and light gray (5Y 7/2) loamy sand, pale olive (5Y 6/3) and olive gray (5Y 5/2) moist; single grain; loose; many very fine interstitial pores; electrical conductivity is 5.5 millimhos per centimeter; exchangeable sodium percentage is 31; moderately alkaline; abrupt wavy boundary.

C4—19 to 24 inches; variegated pale yellow (5Y 8/3) and light gray (5Y 7/2) loamy fine sand, pale yellow (5Y 7/3) and olive (5Y 5/3) moist; massive; loose; many very fine interstitial pores; electrical conductivity is 6.5 millimhos per centimeter; exchangeable sodium percentage is 33; moderately alkaline; abrupt wavy boundary.

C5—24 to 32 inches; variegated white (5Y 8/2) and light gray (5Y 7/2) loamy fine sand, olive gray (5Y 5/2) and pale yellow (5Y 7/3) moist; massive; loose; many very fine interstitial pores; common strata of very fine sandy loam to sandy loam 3 to 10 millimeters thick; electrical conductivity is 12 millimhos per centimeter; exchangeable sodium percentage is 45; moderately alkaline; abrupt wavy boundary.

C6—32 to 60 inches; variegated pale yellow (5Y 8/3) and pale yellow (5Y 7/3) loamy fine sand, olive gray (5Y 5/2) and pale olive (5Y 6/3) moist; massive; loose; many very fine interstitial pores; common strata of very fine sandy loam to sandy loam 3 to 10 millimeters thick; electrical conductivity is 18 millimhos per centimeter; exchangeable sodium percentage is 42; moderately alkaline.

The profile is weakly stratified. The depth to a perched water table ranges from 2 to 4 feet. The profile is saturated, virtually free of dissolved oxygen, some time of the year. It typically is strongly saline-alkali but ranges to slightly saline-alkali.

The A horizon has dry color of 5Y 6/2 or 7/2 or of 2.5Y 7/2 or 6/2, and it has moist color of 5Y 4/2 or 5/2 or of 2.5Y 4/2 or 5/2. It is strongly effervescent or violently effervescent. The lime is disseminated.

The C horizon has dry color of 5Y 7/2, 7/3, 8/2, 8/3, or 8/4 or of 2.5Y 5/2 or 6/2, and it has moist color of 5Y 5/2, 5/3, 6/3, or 7/3 or of 2.5Y 3/2 or 4/2. Mottles are few to many, fine or medium, and distinct and have moist color of 5GY 4/1, 5BG 4/1, 5Y 6/4, or 10YR 4/6. More than 40 percent of the moist matrix colors, between depths of 10 and 30 inches, have chroma of 3 or more when mottles are present in the C horizon. Chroma is 2 or 3 when no mottles are present. This horizon is dominantly loamy sand and loamy fine sand with thin strata of very fine sandy loam, fine sandy loam, or sandy loam. Typically, it is slightly effervescent to strongly effervescent. Disseminated lime extends to a depth of 15 inches. The horizon commonly is noneffervescent below a depth of 15 inches, but lime is present below this depth in some pedons.

Houser Series

The Houser series consists of very deep, somewhat poorly drained, saline-alkali soils on basin rims. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Houser series are fine, montmorillonitic (calcareous), thermic Vertic Fluvaquents.

Typical pedon of Houser clay, partially drained; about 150 feet north of Blakeley Canal; 150 feet west and 825 feet south of the northeast corner of sec. 7, T. 23 S., R. 20 E.

Ap—0 to 9 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots; few very fine interstitial and tubular pores; disseminated lime; electrical conductivity is 3.5 millimhos per centimeter; exchangeable sodium percentage is 9; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A12sacs—9 to 20 inches; gray (5Y 6/1) clay, variegated very dark olive gray (5Y 3/2) and olive (5Y 4/3) moist; common fine prominent yellowish brown (10YR 5/4) mottles, yellowish brown (10YR 5/6) moist; moderate coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots; few very fine interstitial and tubular pores; few fine black concretions; disseminated lime; common scattered gypsum crystals; electrical conductivity is 14 millimhos per centimeter; exchangeable sodium percentage is 31; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1sacs—20 to 23 inches; light olive gray (5Y 6/2) silt loam, olive (5Y 5/3) moist; common fine prominent yellowish brown (10YR 5/6) mottles, dark brown (7.5YR 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; common scattered gypsum crystals; electrical conductivity is 19 millimhos per centimeter; exchangeable sodium percentage is 42; moderately alkaline; abrupt wavy boundary.

C2sacs—23 to 31 inches; gray (5Y 6/1) clay, olive gray (5Y 4/2) moist; many medium prominent yellowish brown (10YR 5/4) mottles, yellowish brown (10YR 5/6) moist; massive; extremely hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; common scattered gypsum crystals; electrical conductivity is 28 millimhos per centimeter; exchangeable sodium percentage is 44; moderately alkaline; abrupt smooth boundary.

C3sacs—31 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; many medium prominent dark brown (7.5YR 4/4) mottles, yellowish red (5YR 4/6) moist; massive; extremely hard, firm, sticky and very plastic; few very fine roots; few very fine tubular pores; common scattered gypsum crystals; electrical conductivity is 30 millimhos per centimeter; exchangeable sodium percentage is 43; moderately alkaline.

The profile is stratified. Vertical cracks extend from the surface and are 1 to 3 centimeters wide at a depth of 50 centimeters at some time in most years. A few slickensides are present in some pedons, but they do not intersect. The organic matter content is 1 percent or less at the surface and decreases irregularly with increasing depth. The profile typically is saline-alkali throughout. The upper 20 inches of the profile ranges from slightly effervescent to violently effervescent. The C horizon ranges from noneffervescent to violently effervescent. Gypsum crystals may be present in some or all horizons below a depth of 9 inches. Salic horizons are present below a depth of 30 inches in some pedons. Few to many, fine or medium, and distinct or prominent mottles are present in the lower part of the A horizon and in the C horizon. They have moist color of 10YR 5/6 or 5/4, of 7.5YR 4/4, of 5YR 4/6 or 4/4, of 5Y 4/1, of 2.5Y 7/6, or of N 2.5/0.

The A horizon has dry color of 5Y 7/1, 6/1, or 6/2, and it has moist color of 5Y 3/2, 4/2, 5/2, or 4/3. This horizon is moderately alkaline or strongly alkaline.

The C horizon has dry color of 5Y 5/1, 6/1, 7/1, 5/2, or 6/2, of 2.5Y 6/2, or of 10YR 7/3, and it has moist color of 5Y 4/1, 4/2, 5/2, 5/3, or 4/3, of 2.5Y 4/2, or of 10YR 5/4. It is clay or silty clay and has thin strata of silt

loam or silty clay loam. This horizon is moderately alkaline or strongly alkaline.

Kettleman Series

The Kettleman series consists of moderately deep, well drained soils on hills and uplands. These soils formed in residuum derived dominantly from sandstone or shale. Slope ranges from 5 to 50 percent.

Soils of the Kettleman series are fine-loamy, mixed (calcareous), thermic Typic Torriorthents.

Typical pedon of Kettleman loam, 15 to 30 percent slopes; about 3.5 miles south of the city of Avenal, in the NW1/4NW1/4SE1/4 of sec. 3, T. 23 S., R. 20 E.

A11—0 to 0.5 inch; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A12—0.5 to 13 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; disseminated lime; slightly effervescent; neutral; abrupt wavy boundary.

C1—13 to 39 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; disseminated lime and common fine lime filaments; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2r—39 inches; grayish brown (10YR 5/2) fine-grained calcareous sandstone with many medium lime filaments.

Depth to paralithic contact of sandstone or shale is 20 to 40 inches. The part of the profile between depths of 4 and 12 inches is dry from April to mid-January and is not continuously moist for as long as 90 consecutive days.

The A horizon has dry color of 10YR 4/3, 5/3, 5/4, 6/2, or 6/3, and it has moist color of 10YR 3/3, 4/2, 4/3, or 5/3. The organic matter content is less than 0.5 percent. The horizon is neutral to moderately alkaline.

The C horizon has dry color of 10YR 5/2, 5/3, 5/4, 6/3, or 6/4, and it has moist color of 10YR 4/2, 4/3, 4/4, 5/3, or 5/4. It is slightly effervescent to violently effervescent.

Kimberlina Series

The Kimberlina series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Kimberlina series are coarse-loamy, mixed (calcareous), thermic Typic Torriorthents.

Typical pedon of Kimberlina fine sandy loam, sandy substratum; about 0.45 mile east of 10th Avenue and 150 feet north of Fargo Avenue; in the SW1/4SE1/4SE1/4 of sec. 18, T. 18 S., R. 22 E.

Ap1—0 to 1 inch; light brownish gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; many very fine interstitial pores and many fine tubular pores; neutral; abrupt smooth boundary.

Ap2—1 to 8 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and very fine roots; common fine tubular pores; moderately alkaline; abrupt smooth boundary.

C1—8 to 13 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; common fine tubular pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2—13 to 28 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; hard, firm, slightly sticky and nonplastic; common fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C3—28 to 41 inches; light brownish gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) moist; massive; soft, friable, nonsticky and nonplastic; common fine tubular pores; moderately alkaline; abrupt smooth boundary.

IIC4—41 to 60 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; massive; loose, nonsticky and nonplastic; many very fine interstitial pores; neutral.

The part of the profile between depths of 8 and 24 inches is dry all the time from April until mid-January and is moist in all parts for less than 60 consecutive days in winter.

The A horizon has dry color of 10YR 6/2, 6/3, or 7/2, and it has moist color of 10YR 3/2, 4/2, 4/3, or 5/2. It is noneffervescent to violently effervescent. The lime is disseminated.

The C horizon has dry color of 10YR 5/2, 5/3, 6/2, 6/3, 7/2, or 7/3 or of 2.5Y 6/2 or 7/2, and it has moist color of 10YR 3/2, 3/3, 4/2, 4/3, or 5/2 or of 2.5Y 4/2. It is fine sandy loam, sandy loam, or very sandy loam. It is noneffervescent to violently effervescent.

Kreyenhagen Series

The Kreyenhagen series consists of deep, well drained soils on mountains. These soils formed in residuum derived dominantly from sandstone. Slope ranges from 50 to 75 percent.

Soils of the Kreyenhagen series are fine-silty, mixed, thermic Typic Haploxeralfs.

Typical pedon of Kreyenhagen loam, 50 to 75 percent slopes; about 10 miles northwest of Highway 41 in Avenal Canyon, before Blacks Corral; 70 feet west of the intersection of the jeep road and Little Avenal Creek; in the SW1/4SE1/4NE1/4 of sec. 16, T. 23 S., R. 16 E.

A1—0 to 2 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; strong medium subangular blocky structure parting to strong fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores and many very fine and fine tubular pores; neutral; abrupt wavy boundary.

B21t—2 to 8 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and common fine roots; many very fine interstitial pores and many very fine and fine tubular pores; many moderately thick clay films on peds and in pores; neutral; abrupt wavy boundary.

B22t—8 to 21 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine interstitial pores and many very fine and fine tubular pores; many moderately thick clay films on peds and in pores; neutral; clear wavy boundary.

B23t—21 to 36 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine, common medium, and few coarse roots; many very fine interstitial pores and many very fine and fine tubular pores; many moderately thick clay films on peds and in pores; neutral; clear wavy boundary.

B24t—36 to 45 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; very hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; many very fine interstitial pores and many very fine and fine tubular pores; continuous moderately thick clay films on peds and in pores; mildly alkaline; clear irregular boundary.

Cr—45 inches; brownish yellow (10YR 6/6) weakly consolidated sandstone that slakes in water.

Depth to paralithic contact is 40 to 60 inches or more. The part of the profile between depths of 5 and 16 inches is usually moist in all parts from January 1 to April 30. It is usually dry in all parts from July 1 to September 1.

The A horizon has dry color of 10YR 6/3, 5/2, or 5/3, and it has moist color of 10YR 4/2 or 4/3. Clay content is 20 to 27 percent. The horizon is neutral or mildly alkaline.

The B horizon has dry color of 10YR 6/3, 5/2, 5/3, or 5/4, and it has moist color of 10YR 4/2 or 4/3. It is clay loam or silty clay loam. The clay content averages 30 to 35 percent and is estimated to be 5 to 9 percent more than that of the A horizon. The fine earth fraction has, by weight, less than 11 percent sand that is fine or coarser in the control section. The horizon is neutral to moderately alkaline.

Lakeside Series

The Lakeside series consists of very deep, somewhat poorly drained, saline-alkali soils on basin rims and alluvial plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Lakeside series are fine-loamy, mixed, thermic Fluvaquentic Haploxerolls.

Typical pedon of Lakeside loam, partially drained; about 4 miles southwest of the city of Lemoore, about 1,475 feet east of 19th Avenue and 560 feet north of Java Avenue; about 1,165 feet west and 560 feet north of the center of sec. 34, T. 19 S., R. 20 E.

Ap—0 to 4 inches; gray (5Y 5/1) loam, very dark gray (5Y 3/1) moist; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; electrical conductivity is 5.5 millimhos per centimeter; exchangeable sodium percentage is 2; neutral; abrupt smooth boundary.

A12—4 to 9 inches; olive gray (5Y 5/2) fine sandy loam, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to coarse subangular blocky; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; few fine segregated lime filaments; electrical conductivity is 5 millimhos per centimeter; exchangeable sodium percentage is 4; slightly effervescent; moderately alkaline; abrupt smooth boundary.

A13sa—9 to 17 inches; olive gray (5Y 5/2) loam, very dark gray (5Y 3/1) moist; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; disseminated lime and common fine segregated lime filaments; electrical conductivity is 10 millimhos per centimeter; exchangeable sodium

percentage is 14; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C1sa—17 to 23 inches; light olive gray (5Y 6/2) loam, dark gray (5Y 4/1) moist; massive; hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular pores; few fine segregated lime filaments and soft masses; electrical conductivity is 10.5 millimhos per centimeter; exchangeable sodium percentage is 23; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C2sa—23 to 28 inches; pale yellow (5Y 7/3) clay loam, olive gray (5Y 4/2) moist; massive; hard, very friable, sticky and plastic; many very fine roots; many very fine and fine tubular pores; few fine segregated lime filaments and soft masses; electrical conductivity is 22.5 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C3gsa—28 to 35 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine faint dark gray (5Y 4/1) mottles, very dark gray (5Y 3/1) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; few very fine interstitial pores and common very fine tubular pores; few fine segregated lime filaments and soft masses; electrical conductivity is 11 millimhos per centimeter; exchangeable sodium percentage is 22; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C4g—35 to 42 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine faint dark gray (5Y 4/1) mottles, very dark gray (5Y 3/1) moist; massive; hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; few fine segregated lime filaments and soft masses; electrical conductivity is 9 millimhos per centimeter; exchangeable sodium percentage is 16; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIA1bg—42 to 48 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; common fine faint dark gray (5Y 4/1) mottles, very dark gray (5Y 3/1) moist; massive; slightly hard, very friable, sticky and plastic; few very fine roots; common very fine and fine tubular pores; disseminated lime; electrical conductivity is 8.5 millimhos per centimeter; exchangeable sodium percentage is 23; strongly effervescent; moderately alkaline; clear smooth boundary.

IIC5bg—48 to 60 inches; light olive gray (5Y 6/2) loam, olive gray (5Y 4/2) moist; common fine prominent dark yellowish brown (10YR 4/6) mottles, dark yellowish brown (10YR 4/6) moist; massive; slightly hard, friable, sticky and slightly plastic; few very fine roots; few fine and many very fine tubular pores; disseminated lime and common segregated lime filaments, soft masses, and concretions; electrical conductivity is 8 millimhos per centimeter; exchangeable sodium percentage is 23; violently effervescent; moderately alkaline.

The profile is 60 inches deep or more and is stratified. The part of the profile between depths of about 4 and 12 inches is moist for 120 consecutive days following the winter solstice. The soil temperature is more than 47 degrees F. Organic matter content is 1 to 2 percent in the A horizon and decreases irregularly with increasing depth. The soil is slightly saline-alkali to moderately saline-alkali.

The A horizon has dry color of 10YR 5/1 or of 5Y 5/1 or 5/2, and it has moist color of 10YR 3/2 or of 5Y 3/1 or 3/2. Depth to lime ranges from 2 to 6 inches. Reaction is neutral to moderately alkaline.

The C horizon has dry color of 5Y 5/2, 6/2, 7/1, or 7/3, and it has moist color of 5Y 4/1, 4/2, 4/3, or 6/2. Moist mottles are faint to prominent and have color of 7.5YR 4/4, of 10YR 4/6 or 5/6, of 2.5Y 4/4 or 6/2, or of 5Y 3/1 or 3/2. Moist mottles with chroma of 1 or 2 are within 30 inches of the surface. The horizon commonly is loam or clay loam, but there are thin strata in some pedons that range from sand to clay. The weighted average clay content is 20 to 35 percent. In some pedons 0 to 15 percent durinodes are in the lower part. Reaction is mildly alkaline to strongly alkaline.

Lemoore Series

The Lemoore series consists of very deep, somewhat poorly drained, saline-alkali soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Lemoore series are coarse-loamy, mixed (calcareous), thermic Aeric Haplaquents.

Typical pedon of Lemoore sandy loam, partially drained; about 0.75 mile east of Highway 41 and 0.25 mile north of Jackson Avenue; about 1,500 feet north and 1,650 feet east of the southwest corner of sec. 22, T. 19 S., R. 20 E.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine and many very fine roots; few very fine tubular pores and common very fine interstitial pores; electrical conductivity is 0.9 millimho per centimeter; exchangeable sodium percentage is 2; neutral; abrupt smooth boundary.

A12—7 to 13 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; few very fine

tubular pores and common very fine interstitial pores; disseminated lime; electrical conductivity is 0.4 millimho per centimeter; exchangeable sodium percentage is 6; slightly effervescent; moderately alkaline; clear wavy boundary.

A13—13 to 16 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, firm, nonsticky and nonplastic; many very fine roots; few very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 0.8 millimho per centimeter; exchangeable sodium percentage is 8; slightly effervescent; strongly alkaline; clear wavy boundary.

C1—16 to 24 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine faint light yellowish brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; massive; slightly hard, firm, nonsticky and nonplastic; common very fine roots; few very fine tubular pores and common very fine interstitial pores; disseminated lime; electrical conductivity is 0.6 millimho per centimeter; exchangeable sodium percentage is 6; slightly effervescent; very strongly alkaline; abrupt wavy boundary.

C2—24 to 34 inches; light brownish gray (2.5Y 6/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; common fine faint and many fine prominent reddish yellow (5YR 6/6) mottles, dark reddish brown (2.5YR 3/4) moist; massive; hard, very friable, nonsticky and slightly plastic; common very fine roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 2.6 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; very strongly alkaline; abrupt wavy boundary.

C3—34 to 44 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine faint light yellowish brown (2.5Y 6/4) mottles, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 2.6 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; very strongly alkaline; clear wavy boundary.

C4—44 to 51 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; common medium faint light olive brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; massive; hard, friable, nonsticky and nonplastic; common very fine roots; common very fine tubular and interstitial pores; disseminated lime; electrical conductivity is 3.2 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; very strongly alkaline; gradual wavy boundary.

C5—51 to 60 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; common medium faint light yellowish brown (2.5Y 6/4) mottles, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; few very fine tubular and interstitial pores; disseminated lime; electrical conductivity is 3.2 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; very strongly alkaline.

The organic matter content is less than 1 percent at the surface and decreases regularly with increasing depth. The profile is slightly effervescent to strongly effervescent. Disseminated lime is below a depth of 7 inches. The exchangeable sodium percentage is 2 to 15 in the upper part of the profile, and it increases with increasing depth to 15 to 80 in the lower part.

The A horizon has dry color of 2.5Y 6/2 or 7/2 or of 10YR 6/3, and it has moist color of 2.5Y 4/2 or 10YR 3/2. It is neutral to strongly alkaline.

The C horizon has moist color of 2.5Y 3/2, 4/2, or 5/2. Mottles are few to many, fine or medium, and faint to prominent, and they have moist color of 2.5Y 4/4 or 5/4 or of 2.5YR 3/4 or 4/4. Texture is sandy loam or fine sandy loam. This horizon is strongly alkaline or very strongly alkaline.

Lethent Series

The Lethent series consists of very deep, moderately well drained, saline-alkali soils on lower alluvial fans and basin rims. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Lethent series are fine, montmorillonitic, thermic Typic Natrargids.

Typical pedon of Lethent clay loam; about 50 feet east of 25th Avenue; 880 feet north and 50 feet east of the west quarter corner of sec. 22, T. 19 S., R. 19 E.

Ap—0 to 6 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; strong coarse subangular blocky structure; slightly hard, very friable, sticky and plastic; many very fine and fine roots and few medium roots; many very fine interstitial and tubular pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

B21tca—6 to 13 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; hard, friable, sticky and very plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores and

many very fine and fine tubular pores; few thin clay films on peds and in pores; common scattered gypsum crystals; lime is disseminated and in common fine irregular lime filaments and soft masses; strongly effervescent; moderately alkaline; abrupt smooth boundary.

B22tca—13 to 24 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable, sticky and very plastic; many very fine roots; many very fine interstitial and tubular pores; few thin clay films on peds and in pores; common scattered gypsum crystals; lime is disseminated and in few fine irregular soft lime masses; strongly effervescent; moderately alkaline; abrupt smooth boundary.

B3t—24 to 31 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure; hard, friable, sticky and plastic; many very fine roots; common very fine interstitial and tubular pores; few thin clay films on peds and in pores; common scattered gypsum crystals; moderately alkaline; abrupt wavy boundary.

C1—31 to 52 inches; light yellowish brown (2.5Y 6/4) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine interstitial pores and many very fine and fine tubular pores; strongly alkaline; abrupt wavy boundary.

C2—52 to 60 inches; light yellowish brown (2.5Y 6/4) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; strongly alkaline.

The part of the profile between depths of 4 and 12 inches is dry more than 75 percent of the time (cumulative) and is not continuously moist for as long as 75 days. The organic matter content is less than 0.5 percent. The profile is moderately alkaline to very strongly alkaline. Electrical conductivity of the saturation extract ranges from 4 to 40 millimhos per centimeter.

The A horizon has dry color of 5Y 6/1, of 2.5Y 4/2, 5/2, 6/2, or 7/2, or of 10YR 6/3, and it has moist color of 5Y 3/2, of 2.5Y 3/2, 4/2, or 4/4, or of 10YR 4/3. It commonly is slightly effervescent to strongly effervescent, but it is noneffervescent in some pedons. The lime is disseminated.

The Bt horizon has dry color of 5Y 5/2 or 6/1, of 2.5Y 5/2, 5/4, 6/2, 6/4, or 7/2, or of 10YR 6/3, and it has moist color of 5Y 2/2, 3/2, or 4/1, of 2.5Y 3/2, 4/2, or 4/4, or of 10YR 4/2. It is heavy clay loam, silty clay loam, clay, or silty clay and averages 35 to 55 percent clay. The B2tca horizon is slightly effervescent to violently effervescent. The lime is disseminated or in filaments and soft masses. The estimated exchangeable sodium percentage within the natric horizon ranges from 15 to 75.

The C horizon has dry color of 5Y 6/2, 6/4, 8/1, or 8/2, of 2.5Y 5/2, 5/4, or 6/4, or of 10YR 6/3, and it has moist color of 5Y 4/3, 5/3, 6/3, 6/4, 7/2, or 7/3, of 2.5Y 4/2 or 4/4, or of 10YR 4/3. In some pedons the horizon is mottled. The horizon is sandy loam, silt loam, loam, clay loam, or silty clay loam. In some pedons it is effervescent. Gypsum crystals are present in some pedons.

Melga Series

The Melga series consists of very deep, somewhat poorly drained, saline-alkali soils on flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Melga series are fine-silty, mixed, thermic Duric Natrargids.

Typical pedon of Melga silt loam, about 0.3 mile north of Grangeville Boulevard and 600 feet west of Cross Creek; 1,200 feet south and 750 feet east of the center of sec. 24, T. 18 S., R. 22 E.

A1—0 to 1 inch; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores; electrical conductivity is 1.5 millimhos per centimeter; exchangeable sodium percentage is 12; medium acid; abrupt smooth boundary.

A2—1 to 4 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; strong very thick platy structure; hard, firm, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; few moderately thick clay films in pores; electrical conductivity is 1.0 millimho per centimeter; exchangeable sodium percentage is 11; mildly alkaline; abrupt smooth boundary.

B21tca—4 to 11 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; many thin clay films in pores and on peds; lime is disseminated and in common fine irregularly shaped soft masses and filaments; electric conductivity is 10 millimhos per centimeter; exchangeable sodium percentage is 78; violently effervescent; very strongly alkaline; abrupt wavy boundary.

B22tca—11 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; very hard, firm, very sticky and plastic; common fine roots;

many very fine tubular pores; few fine black concretions; many moderately thick clay films in pores and on peds; lime is disseminated and in many medium irregularly shaped soft masses, filaments, and concretions; electrical conductivity is 6.4 millimhos per centimeter; exchangeable sodium percentage is 51; strongly effervescent; very strongly alkaline; abrupt wavy boundary.

C1sica—18 to 26 inches; very pale brown (10YR 8/3) clay loam, pale brown (10YR 6/3) moist; massive; extremely hard and brittle when dry, very firm, sticky and plastic; common fine tubular pores; disseminated lime; electrical conductivity is 5 millimhos per centimeter; dry bulk density is 2.20 grams per cubic centimeter; violently effervescent; very strongly alkaline; abrupt wavy boundary.

IIC2—26 to 41 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; common fine distinct reddish yellow (7.5YR 7/6) mottles, strong brown (7.5YR 5/6) moist; massive; hard, firm, nonsticky and nonplastic; many very fine and fine tubular pores; very few moderately thick clay films in pores; lime is segregated in few fine irregularly shaped soft masses; electrical conductivity is 4 millimhos per centimeter; exchangeable sodium percentage is 54; slightly effervescent; very strongly alkaline; abrupt smooth boundary.

IIIC3—41 to 59 inches; light yellowish brown (10YR 6/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; common fine distinct reddish yellow (7.5YR 6/6) mottles, strong brown (7.5YR 5/8) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine interstitial pores and common very fine tubular pores; very few moderately thick clay films in pores; lime is segregated in few fine irregularly shaped soft masses and filaments; electrical conductivity is 2.2 millimhos per centimeter; exchangeable sodium percentage is 30; slightly effervescent; strongly alkaline; abrupt smooth boundary.

IIIC4—59 to 60 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine interstitial pores and common very fine tubular pores; electrical conductivity is 0.8 millimho per centimeter; exchangeable sodium percentage is 15; very strongly alkaline.

The thickness of the solum and the depth to a horizon that is weakly cemented with silica and lime range from 10 to 20 inches. The part of the profile between depths of 4 and 10 inches is dry in all parts from April 1 until December 1 and is not moist in some or all parts for as long as 90 consecutive days. It is dry in all parts intermittently the rest of the year.

The A horizon has dry color of 10YR 4/2, 5/2, 6/1, or 6/2 or of 2.5Y 5/2, and it has moist color of 10YR 3/2 or 4/2 or of 2.5Y 4/2. It is medium acid or slightly acid.

The A2 horizon has dry color of 2.5Y 6/2 or 7/2 or of 10YR 7/1, and it has moist color of 2.5Y 4/2 or 5/2 or of 10YR 5/1 or 5/2. It is neutral or mildly alkaline.

The B2t horizon has dry color of 10YR 4/2, 5/3, 6/3, or 6/4 or of 2.5Y 4/2, and it has moist color of 10YR 3/2, 4/2, or 5/4 or of 2.5Y 3/2. Mottles are present in some pedons and have moist color of N 2/0 or 10YR 4/4. Clay content averages 27 to 35 percent and is estimated to be 5 to 18 percent more than that in the A horizon. Less than 15 percent of the particles are sand that is fine or coarser by weighted average. Electrical conductivity ranges from 4 to 16 millimhos per centimeter. The exchangeable sodium percentage ranges from 40 to 80. The calcium carbonate equivalent ranges from 1 to 3 percent.

The C1sica horizon has dry color of 10YR 8/3 or 5/3, and it has moist color of 10YR 6/3 or 4/2. It is weakly cemented with silica and lime, is extremely hard and brittle when dry, and has very firm consistency when moist. During prolonged soaking in water or hydrochloric acid, fragments slake and the resultant mass contains 15 to 40 percent plate-shaped fragments smaller than 2 millimeters and less than 2 percent angular durinodes ranging in size from 2 to 5 millimeters. The calcium carbonate equivalent ranges from 10 to 12 percent. Electrical conductivity ranges from 4 to 8 millimhos per centimeter. The exchangeable sodium percentage ranges from 50 to 65.

The lower part of the C horizon has dry color of 10YR 5/3, 6/4, or 7/3 or of 2.5Y 5/4, and it has moist color of 10YR 4/3, 4/4, 5/3, 5/4, or 6/3 or of 2.5Y 4/2. Strata of varying textures range from fine sandy loam to silty clay loam. They are noneffervescent to strongly effervescent. The lime is disseminated or segregated in soft masses, filaments, or seams. Electrical conductivity of the C horizon ranges from 0.5 to 16 millimhos per centimeter. The exchangeable sodium percentage ranges from 15 to 65.

Mercey Series

The Mercey series consists of moderately deep, well drained, hilly soils on uplands. These soils formed in residuum derived dominantly from sandstone or shale. Slope ranges from 5 to 50 percent.

Soils of the Mercey series are fine-silty, mixed, thermic Typic Camborthids.

Typical pedon of Mercey loam, 5 to 15 percent slopes; in the Pyramid Hills, about 0.5 mile southeast of Highway 41 and 0.75 mile northeast of Cottonwood Pass Fire Station, in the NE1/4NW1/4NE1/4 of sec. 7, T. 24 S., R. 18 E.

A1—0 to 2.5 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few very fine tubular pores; neutral; abrupt smooth boundary.

B1—2.5 to 9 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to strong medium subangular blocky; slightly hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

B2—9 to 16 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; very few thin clay films in pores; disseminated lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

C1—16 to 25 inches; light yellowish brown (2.5Y 6/4) heavy loam, olive brown (2.5Y 4/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; disseminated lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2r—25 inches; light yellowish brown (2.5Y 6/4), highly fractured, fine-grained, calcareous sandstone that slakes in water and is easily broken to gravel-sized particles; fractures are 0.5 to 1.0 inch apart; no roots in fractures.

Depth to paralithic contact is 20 to 40 inches. The soil at a depth of 4 to 12 inches is dry in all parts from mid-April to mid-January. Soil temperature is more than 47 degrees F at all times. The profile is not continuously moist in some part for 90 consecutive days. The profile is 5 to 7 percent calcium carbonate, which increases slightly immediately above the paralithic contact.

The A horizon is neutral or mildly alkaline. It is loam or clay loam. Less than 15 percent, by weight, of the soil particles are sand that is fine or coarser.

The B and C horizons are 20 to 30 percent clay.

Milham Series

The Milham series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Milham series are fine-loamy, mixed, thermic Typic Haplargids.

Typical pedon of Milham sandy loam, silty substratum; about 2 miles south of Utica Avenue, 50 feet east and 30 feet north of the southwest corner of sec. 19, T. 23 S., R. 20 E.

Ap—0 to 7 inches; light yellowish brown (2.5Y 6/4) sandy loam, olive brown (2.5Y 4/4) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores and common very fine interstitial pores; moderately alkaline; abrupt wavy boundary.

A12—7 to 14 inches; light yellowish brown (2.5Y 6/4) sandy loam, olive brown (2.5Y 4/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores and common very fine interstitial pores; moderately alkaline; abrupt smooth boundary.

B21tca—14 to 18 inches; light yellowish brown (2.5Y 6/4) sandy clay loam, olive brown (2.5Y 4/4) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and many very fine roots; few very fine tubular pores and common very fine interstitial pores; common thin clay films on peds and in pores; common fine soft lime masses; slightly effervescent; moderately alkaline; clear wavy boundary.

B22tca—18 to 21 inches; light yellowish brown (2.5Y 6/4) sandy clay loam, olive brown (2.5Y 4/4) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine roots; few very fine tubular pores and common very fine interstitial pores; many moderately thick clay films on peds and in pores; many fine lime filaments and soft masses; strongly effervescent; moderately alkaline; abrupt wavy boundary.

B23tca—21 to 28 inches; light yellowish brown (2.5Y 6/4) sandy clay loam, olive brown (2.5Y 4/4) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; many very fine roots; common very fine tubular and interstitial pores; many moderately thick clay films on peds and in pores; disseminated lime and many fine lime filaments and concretions; violently effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—28 to 32 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular and interstitial pores; few fine soft lime masses; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—32 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine roots; many very fine and few fine tubular pores

and common very fine interstitial pores; disseminated lime and few fine lime filaments and soft masses; violently effervescent; moderately alkaline.

The part of the profile between depths of 4 and 12 inches is dry all the time from April until mid-January. Total sand content of the profile is 35 to 60 percent, and silt content is 10 to 35 percent.

Millsholm Series

The Millsholm series consists of shallow, well drained soils on hills and mountains. These soils formed in residuum derived dominantly from sandstone. Slope ranges from 15 to 75 percent.

Soils of the Millsholm series are loamy, mixed, thermic Lithic Xerochrepts.

Typical pedon of Millsholm clay loam, 50 to 75 percent slopes, in the NE1/4NW1/4NE1/4 of sec. 34, T. 23 S., R. 16 E.

A1—0 to 4 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; strong coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores and common very fine tubular pores; neutral; abrupt wavy boundary.

B2—4 to 17 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; strong coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores and many very fine, common fine, and few medium tubular pores; many thin clay films in pores; neutral; abrupt wavy boundary.

R—17 inches; light yellowish brown (10YR 6/4) fractured sandstone.

Depth to sandstone is 10 to 20 inches. The profile is moist between depths of 4 and 12 inches in some or all parts between November and May. It is dry the rest of the year.

The A horizon has dry color of 10YR 6/4 or 5/4, and it has moist color of 10YR 5/4 or 4/3. It is slightly acid or neutral.

The B2 horizon has dry color of 10YR 4/4 or 4/3.

Nord Series

The Nord series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Nord series are coarse-loamy, mixed, thermic Cumulic Haploxerolls.

Typical pedon of Nord fine sandy loam; about 30 feet west of 11th Avenue and 250 feet south of Excelsior Avenue; about 30 feet west and 250 feet south of the northeast corner of sec. 2, T. 18 S., R. 21 E.

A11—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; neutral; abrupt smooth boundary.

A12—9 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and few very fine tubular pores; disseminated lime and few fine lime filaments; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C1—18 to 34 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots and few medium roots; many very fine interstitial pores and common very fine and fine tubular pores; disseminated lime and few fine lime filaments; strongly effervescent; mildly alkaline; abrupt smooth boundary.

C2—34 to 52 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and many very fine and fine tubular pores; disseminated lime and few fine lime filaments; strongly effervescent; mildly alkaline; abrupt wavy boundary.

A13b—52 to 57 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial and tubular pores; mildly alkaline; abrupt wavy boundary.

A14b—57 to 72 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; mildly alkaline.

The part of the profile between depths of 8 to 24 inches is moist in all parts from about December 15 to April 15. It is dry in all parts from July 15 to November 15. The organic matter content is more than 1 percent at a depth of 20 inches, and it decreases irregularly with increasing depth.

The A horizon has dry color of 10YR 4/3, 5/2, or 5/3 or of 2.5Y 4/2 or 5/2, and it has moist color of 10YR

3/1, 3/2, or 3/3. It is neutral to moderately alkaline. The profile typically is slightly effervescent to strongly effervescent and has disseminated lime or lime in filaments or threads. Some pedons are noneffervescent in the A11 horizon and in horizons below a depth of 4 feet.

The C horizon has dry color of 10YR 5/2, 5/3, or 6/3 or of 2.5Y 5/2, and it has moist color of 10YR 3/2, 3/3, 4/2, 4/3, or 5/2 or of 2.5Y 3/2 or 4/2. Dry value of 5 and moist value of 3 are present in the upper part of the C horizon. Reddish yellow, light brownish gray, or light yellowish brown mottles are present below a depth of 4 feet in some pedons. The mottles increase in number near old slough areas. This horizon is loam, sandy loam, very fine sandy loam, or fine sandy loam. Some pedons have silt loam and clay loam strata below a depth of 40 inches. The horizon is mildly alkaline or moderately alkaline.

The buried A horizon is not present in all pedons.

Panoche Series

The Panoche series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Panoche series are fine-loamy, mixed (calcareous), thermic Typic Torriorthents.

Typical pedon of Panoche loam; about 700 feet southwest of the intersection of Highway 33 and Big Tar Canyon Road; in the NE1/4NE1/4NE1/4 of sec. 28, T. 22 S., R. 17 E.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores and many very fine tubular pores; moderately alkaline; abrupt smooth boundary.

A12—7 to 24 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate coarse subangular blocky; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and tubular pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C—24 to 60 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and many fine tubular pores; disseminated lime; slightly effervescent; moderately alkaline.

The part of the profile between depths of 5 and 15 inches becomes moist in some part in the latter part of December and stays moist until about the end of February or until March. It is usually dry the rest of the year. The soil temperature is more than 47 degrees F. Organic matter content is less than 0.5 percent, and it decreases regularly with increasing depth. The profile is effervescent below a depth of 1 inch to 7 inches. Segregated lime is in the C horizon in some pedons.

The A horizon is mildly alkaline to strongly alkaline.

The C horizon has dry color of 10YR 5/3 or of 2.5Y 5/2 or 5/4, and it has moist color of 10YR 4/2 or of 2.5Y 4/2 or 4/4. It is loam or clay loam. Reaction is moderately alkaline or strongly alkaline.

Parkfield Variant

The Parkfield Variant consists of moderately deep, well drained soils on stream terraces. These soils formed in alluvium derived dominantly from sedimentary rock. Slope ranges from 2 to 8 percent.

Soils of the Parkfield Variant are fine, montmorillonitic, thermic Vertic Argixerolls.

Typical pedon of Parkfield Variant gravelly clay loam, 2 to 8 percent slopes; about 2.5 miles west of Highway 41; in the SE1/4NW1/4NW1/4 of sec. 10, T. 24 S., R. 17 E.

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) gravelly clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate thick platy structure parting to strong fine subangular blocky; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; 10 percent cobbles and 20 percent pebbles; neutral; abrupt smooth boundary.

B1t—4 to 15 inches; dark grayish brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; strong coarse subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine roots; many very fine tubular pores; 10 percent cobbles and 2 percent pebbles; common moderately thick clay films in pores and on peds; mildly alkaline; abrupt smooth boundary.

B2t—15 to 32 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong coarse subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 10 percent cobbles and 2 percent pebbles; common moderately thick clay films in pores and on peds; disseminated lime; strongly effervescent; mildly alkaline; abrupt smooth boundary.

C1—32 to 35 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; massive; very hard, firm, very sticky and very plastic; common very fine tubular pores; 10 percent cobbles and 2 percent pebbles; lime is disseminated and is in many medium irregularly shaped filaments and soft masses; violently effervescent; mildly alkaline; abrupt smooth boundary.

IIC2r—35 inches; pale yellow (2.5Y 7/4) calcareous sandstone, weakly cemented with lime (the lime cementation breaks down in hydrochloric acid); pebbles and cobble-sized rock fragments, primarily jasper, are covered with hard lime coatings and make up 50 percent of this horizon.

Depth to lime-cemented sandstone paralithic contact is 20 to 40 inches. The part of the profile between depths 4 and 12 inches is dry in all parts from May 1 to December 1 but is moist for more than 90 consecutive days in most years in winter and early in spring. Vertical cracks extend from the surface and are 1 to 4 centimeters wide at a depth of 50 centimeters at some time of the year. Organic matter content ranges from 1 to 2 percent to a depth of 15 inches.

The A horizon has dry color of 2.5Y 5/2 or 4/2. Reaction is neutral or mildly alkaline. The horizon is 5 to 15 percent cobbles and 5 to 25 percent pebbles.

The B horizon has moist color of 2.5Y 3/2 or 4/2. The upper part of the B horizon has moist value of 3. Reaction is mildly alkaline or moderately alkaline. The horizon is 5 to 10 percent cobbles and 0 to 5 percent pebbles. It has a weighted average clay content of 35 to 50 percent. The B1t horizon is noneffervescent or slightly effervescent. The B2t horizon is slightly effervescent or strongly effervescent. Lime is disseminated or in soft masses.

The C horizon is mildly alkaline or moderately alkaline. It is 5 to 10 percent cobbles and 0 to 5 percent pebbles.

Pitco Series

The Pitco series consists of very deep, somewhat poorly drained, saline-alkali soils on basin rims and flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Pitco series are fine, montmorillonitic, thermic Fluvaquentic Haplaquolls.

Typical pedon of Pitco clay, partially drained; about 1.7 miles northwest of the city of Stratford, about 1.4 miles north of Laurel Avenue and 0.4 mile west of the Kings River levee; about 300 feet east of canal; 1,870 feet east and 835 feet south of the northwest corner of sec. 12, T. 20 S., R. 19 E.

Ap1—0 to 10 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; strong coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores and many very fine interstitial pores; common fine gypsum crystals; mildly alkaline; abrupt wavy boundary.

A12cssa—10 to 16 inches; dark gray (5Y 4/1) clay, black (5Y 2.5/2) moist; strong very coarse subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores and many very fine interstitial pores; common fine gypsum crystals; moderately alkaline; abrupt wavy boundary.

A13gcssa—16 to 23 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; few fine prominent pinkish gray (7.5YR 7/2) mottles, strong brown (7.5YR 5/6) moist; weak very coarse subangular blocky structure; very hard, friable, sticky and plastic; common very fine roots; few very fine tubular pores and common very fine interstitial pores; common fine gypsum crystals; moderately alkaline; abrupt smooth boundary.

IIC1gcssa—23 to 30 inches; dark gray (5Y 4/1) clay loam, very dark gray (5Y 3/1) moist; common fine prominent pink (7.5YR 7/4) mottles, strong brown (7.5YR 5/6) moist, and common medium faint black (5Y 2.5/1, dry or moist) mottles; massive; very hard, friable, sticky and plastic; few very fine tubular pores and common very fine interstitial pores; gypsum crystals in tubular pores; mildly alkaline; abrupt wavy boundary.

IIIC2gcssa—30 to 42 inches; olive gray (5Y 4/2) clay, very dark gray (5Y 3/1) moist; many medium distinct olive (5Y 5/4) mottles, olive (5Y 4/3) moist, and many medium faint black (5Y 2.5/1, dry or moist) mottles; massive; very hard, friable, sticky and plastic; common very fine tubular pores; gypsum crystals in tubular pores; common pressure faces; moderately alkaline; abrupt wavy boundary.

IIIC3gcssa—42 to 60 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; many large distinct olive (5Y 4/4) mottles, olive gray (5Y 4/2) moist, and many large faint black (5Y 2.5/1, dry or moist) mottles; massive; very hard, friable, sticky and very plastic; few very fine tubular pores; common pressure faces; mildly alkaline.

The profile is saturated in a reduced state at some time of the year. Organic matter content is 1 to 2 percent in the A horizon and decreases to about 0.5 percent at a depth of 23 inches, but the decrease is irregular with increasing depth. The profile ranges from slightly saline-alkali to strongly saline-alkali and is noneffervescent.

The A horizon has dry color of 5Y 4/1, 5/1, or 5/2, and it has moist color of 5Y 2.5/2, 3/1, or 3/2. Faint to prominent mottles are in the lower part of the A horizon and have color of 7.5YR 5/6 or 5Y 5/6. Reaction is neutral to strongly alkaline.

The C horizon has dry color of 5Y 4/1, 4/2, 5/1, 5/2, or 6/1, and it has moist color of 5Y 3/1, 3/2, 4/1, 4/2, or 5/1. It has faint, distinct, or prominent mottles that have color of 7.5YR 5/6 or of 5Y 2.5/1, 4/2, 4/3, 4/4, or 5/6. It is clay loam or clay and averages more than 35 percent clay. Reaction is mildly alkaline to strongly alkaline.

Rambla Series

The Rambla series consists of very deep, moderately well drained, saline-alkali soils on basin rims. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Rambla series are sandy over clayey, mixed (calcareous), thermic Typic Fluvaquents.

Typical pedon of Rambla loamy sand, drained; about 100 feet south of Utica Avenue; 1,370 feet west and 100 feet south of the northeast corner of sec. 17, T. 23 S., R. 20 E.

Ap1—0 to 5 inches; gray (5Y 6/1) loamy sand, dark gray (5Y 4/1) moist; single grain; loose; few fine and many very fine roots; many very fine interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—5 to 15 inches; gray (5Y 6/1) loamy sand, dark gray (5Y 4/1) moist; single grain; loose; common very fine roots; many very fine interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1—15 to 19 inches; gray (5Y 6/1) loamy fine sand, dark gray (5Y 4/1) moist; massive; slightly hard, very friable; common very fine roots; common very fine interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIC2gca—19 to 27 inches; gray (5Y 6/1) clay, gray (5Y 5/1) moist; few fine prominent strong brown (7.5YR 4/6) mottles, dark brown (7.5YR 3/4) moist; massive; very hard, firm, very sticky and very plastic; common very fine roots; few fine and common very fine tubular pores; common medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC3gca—27 to 35 inches; gray (5Y 6/1) clay, olive gray (5Y 5/2) moist, many fine prominent yellowish brown (10YR 5/4) mottles, dark yellowish brown (10YR 4/4) moist; massive; very hard, firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; common medium irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

IIC4g—35 to 45 inches; variegated gray (5Y 6/1) and very pale brown (10YR 8/3) clay, olive gray (5Y 5/2) and very pale brown (10YR 7/3) moist; many fine prominent yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, very sticky and very plastic; few very fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

IIIC5g—45 to 60 inches; light gray (5Y 7/1) loamy sand, olive gray (5Y 5/2) moist; massive; loose; many very fine interstitial pores; disseminated lime; slightly effervescent; moderately alkaline.

The organic matter content is less than 1 percent at the surface and decreases irregularly with increasing depth. The profile typically is nonsaline-nonalkali at the surface and saline-alkali below a depth of 19 inches. It is slightly effervescent to strongly effervescent. The lime is disseminated in soft masses.

The A horizon has dry color of 5Y 6/1 or 7/1, and it has moist color of 5Y 4/1 or 5/1.

The C1 horizon is loamy sand to sandy loam and averages 2 to 10 percent clay.

The C horizon has dry color of 5Y 6/1 or 7/1 or of 10YR 7/2 or 8/3, and it has moist color of 5Y 4/1, 5/1, or 5/2 or of 10YR 6/2 or 7/3. There are few to many, fine or medium, distinct or prominent mottles that have color of 7.5YR 3/4 or 4/4 or of 10YR 4/4. The reaction is moderately alkaline or strongly alkaline.

Reefridge Series

The Reefridge series consists of deep, well drained soils on uplands. These soils formed in residuum derived dominantly from shale and sandstone. Slope ranges from 5 to 30 percent.

Soils of the Reefridge series are fine, montmorillonitic, thermic Typic Torrerts.

Typical pedon of Reefridge clay, 5 to 15 percent slopes; at the southern end of Reef Ridge, about one-eighth mile northwest of Highway 41; about 700 feet west and 1,485 feet north of the southeast corner of sec. 1, T. 24 S., R. 17 E.

A11—0 to 1 inch; brown (10YR 5/3) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure parting to strong medium granular; very hard, firm, very sticky and very plastic; many very fine roots; many very fine interstitial pores; neutral; abrupt smooth boundary.

A12—1 to 5 inches; light yellowish brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) moist; strong medium subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A13—5 to 14 inches; light yellowish brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) moist; strong coarse prismatic structure; very hard, firm, very sticky and very plastic; common very fine roots; many very fine and few fine tubular pores; few intersecting slickensides; neutral; abrupt smooth boundary.

C1—14 to 16 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; few fine prominent reddish yellow (7.5YR 6/6) mottles, strong brown (7.5YR 5/6) moist; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; common very fine roots; many very fine and few fine tubular pores; disseminated lime; slightly

effervescent; moderately alkaline; abrupt smooth boundary.

C2cacs—16 to 48 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common medium distinct brownish yellow (10YR 6/8) mottles, yellowish brown (10YR 5/8) moist; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots; many very fine and few fine tubular pores; lime is disseminated and in common fine seams; common fine gypsum crystals; violently effervescent; moderately alkaline; clear smooth boundary.

C3r—48 inches; variegated light olive gray (5Y 6/2), olive yellow (2.5Y 6/6), and yellow (10YR 7/8) interbedded calcareous shale and sandstone.

Depth to paralithic contact of shale or interbedded shale and sandstone ranges from 40 to 60 inches or more. Vertical cracks extend from the surface and are 1 to 5 centimeters wide at a depth of 50 centimeters. The cracks usually close sometime in January or February for less than 60 consecutive days and remain open the rest of the year. Few to many intersecting slickensides are present in some horizons below a depth of 10 inches.

The A horizon has dry color of 10YR 4/3, 5/3, or 5/2 or of 2.5Y 6/4, and it has moist color of 10YR 3/3, 4/3, or 4/2 or of 2.5Y 4/4. In some pedons the A11 horizon has value of 3 when moist, but this horizon is 2 inches thick or less. The A horizon is neutral to moderately alkaline.

The C horizon has dry color of 10YR 4/3, 5/3, or 5/2 or of 2.5Y 5/4, and it has moist color of 10YR 4/2 or 4/3 or of 2.5Y 4/4. Mottles are few to many, fine or medium, and distinct or prominent and have moist color of 7.5YR 5/6 or 6/8 or of 10YR 5/8. The mottles are considered to be relict mottles. This horizon is clay or clay loam and averages 35 to 60 percent clay. It is 0 to 5 percent rock fragments 2 millimeters to 3 inches in size. It is slightly effervescent to violently effervescent. Lime is disseminated or is in seams or soft masses. Electrical conductivity of this horizon ranges from 4 to 8 millimhos per centimeter.

Remnoy Series

The Remnoy series consists of shallow, somewhat poorly drained, saline-alkali soils on alluvial fans and flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 2 percent.

Soils of the Remnoy series are loamy, mixed, thermic, shallow Typic Nadurargids.

Typical pedon of Remnoy very fine sandy loam; about 245 feet west of 4th Avenue and 0.5 mile north of Excelsior Avenue; about 2,500 feet south and 245 feet west of the northeast corner of sec. 36, T. 17 S., R. 22 E.

A1—0 to 1 inch; light brownish gray (2.5Y 6/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; strong medium platy structure; hard, firm, nonsticky and nonplastic; many very fine, fine; and medium roots; many very fine interstitial pores; disseminated lime; strongly effervescent; strongly alkaline; abrupt smooth boundary.

A2—1 to 5 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; strong thick platy structure; hard, firm, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine interstitial pores and few fine vesicular pores; disseminated lime; strongly effervescent; strongly alkaline; abrupt smooth boundary.

B2t—5 to 15 inches; light gray (2.5Y 7/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common fine prominent brownish yellow (10YR 6/8) mottles, yellowish brown (10YR 5/6) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and very plastic; many very fine and fine roots matted on top of pan; common fine and medium tubular pores; common moderately thick clay films in cracks and pores; disseminated lime; slightly effervescent; very strongly alkaline; abrupt irregular boundary.

C1sicam—15 to 23 inches; light gray (2.5Y 7/2), indurated, lime-silica duripan with laminar layer 0.5 to 1 millimeter thick within the duripan, grayish brown (2.5Y 5/4) moist; many fine distinct light olive brown (2.5Y 5/4) mottles, olive brown (2.5Y 4/4) moist; massive; extremely hard; few very fine roots in cracks; common fine tubular pores; common moderately thick clay films in cracks and pores; fragments do not slake during prolonged soaking in water or hydrochloric acid; lime is disseminated and in seams; violently effervescent; very strongly alkaline; abrupt wavy boundary.

C2sicam—23 to 29 inches; light gray (2.5Y 7/2) indurated lime-silica duripan with laminar layer 0.5 to 1 millimeter thick within the duripan, dark grayish brown (2.5Y 4/2) moist; many fine prominent olive yellow (2.5Y 6/6) mottles, olive brown (2.5Y 4/4) moist; massive; very hard, very firm; few very fine tubular pores; fragments do not slake during prolonged soaking in water or hydrochloric acid; lime is disseminated and in seams; violently effervescent; very strongly alkaline; abrupt wavy boundary.

IIC3—29 to 52 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; few fine prominent olive yellow (2.5Y 6/6) mottles, olive brown (2.5Y 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine interstitial pores and common fine tubular pores; disseminated lime; violently effervescent; very strongly alkaline; abrupt wavy boundary.

IIIC4—52 to 63 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine tubular pores; disseminated lime; violently effervescent; very strongly alkaline; abrupt wavy boundary.

IVC5—63 to 70 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; many fine prominent olive yellow (2.5Y 6/6) mottles, olive brown (2.5Y 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; many fine tubular pores; very strongly alkaline.

Depth to a silica and lime duripan ranges from 10 to 20 inches. The profile commonly is effervescent throughout. The lime is disseminated or is in filaments, soft masses, or concretions. The upper part of the A horizon and the lower part of the C horizon are noneffervescent in some pedons. Few to many, fine or medium, and distinct or prominent mottles are present in the B horizon, the duripan, and the C horizon. The mottles have moist color of 5Y 6/3 or 5/3, of 2.5Y 4/4, of 10YR 5/6, 4/6, or 3/6, or of 5YR 4/6.

The A horizon has dry color of 2.5Y 6/2, 7/1, or 7/2. The organic carbon content is less than 0.5 percent. The A2 horizon tongues into the B2t horizon and between prism faces in some pedons.

The B2t horizon has dry color of 2.5Y 5/2, 6/2, or 7/2 or of 10YR 7/3, and it has moist color of 2.5Y 4/2, 5/2, or 4/4 or of 10YR 4/3. It averages 27 to 35 percent clay. The exchangeable sodium percentage ranges from 30 to 100 percent.

The Csicam horizon has dry color of 2.5Y 6/2 or 7/2. The duripan is 10 to 20 percent carbonates. It is not fractured in some pedons. The thickness of the duripan ranges from 10 to 15 inches. The lower part of the C horizon has dry color of 2.5Y 7/2, 6/2, 6/4, or 7/4. It is sandy loam, fine sandy loam, very fine sandy loam, or silt loam.

Sagaser Series

The Sagaser series consists of deep, well drained soils on mountains. These soils formed in residuum derived dominantly from sandstone or shale. Slope ranges from 50 to 75 percent.

Soils of the Sagaser series are fine-loamy, mixed, thermic Typic Argixerolls.

Typical pedon of Sagaser loam, 50 to 75 percent slopes; about 3.5 miles west, northwest of Garza Peak, and 0.5 mile east of Fresno County line on jeep trail; in the NE1/4NE1/4NE1/4 of sec. 8, T. 23 S., R. 16 E.

A1—0 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to very fine subangular blocky; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; many very fine and fine tubular pores; neutral; clear wavy boundary.

B21t—6 to 16 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; many very fine and common fine roots; many very fine and fine tubular pores; many moderately thick clay films in pores and on peds; neutral; clear wavy boundary.

B22t—16 to 26 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse subangular blocky structure; very hard, very friable, sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and common fine tubular pores; about 5 percent gravel-sized hard shale fragments; many moderately thick clay films in pores and on peds; neutral; gradual wavy boundary.

B3t—26 to 34 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, very friable, sticky and plastic; common very fine and many fine roots; common fine tubular pores; about 10 percent hard shale fragments; many moderately thick clay films in pores; neutral; clear wavy boundary.

C1—34 to 42 inches; light yellowish brown (10YR 6/4) shaly clay loam, yellowish brown (10YR 5/4) moist; massive; very hard, very friable, sticky and plastic; common fine roots; common very fine tubular pores; about 20 percent hard shale fragments; neutral; clear wavy boundary.

C2r—42 inches; light gray (2.5Y 7/2) thin weathered coating over light gray (5Y 7/2) highly fractured shale that, when soaked in water or sodium hexametaphosphate, breaks down under moderate pressure to a sticky and plastic clay loam; fractures are 0.5 to 2.0 centimeters apart, with no rotational displacement.

The thickness of the solum is 32 to 48 inches. Depth to paralithic contact is 40 to 60 inches or more. The part of the profile between depths of 4 and 16 inches is usually moist in all parts from about January 1 to April 30. It is usually dry in all parts from about July 1 to September 1. The profile is neutral or mildly alkaline.

The A horizon has dry color of 10YR 4/2, 4/3, 5/2, or 5/3, and it has moist color of 10YR 3/1, 3/2, or 3/3. Organic matter content is 2 to 4 percent in the upper 6 inches and decreases regularly to less than 1 percent at a depth of 14 to 20 inches.

The Bt horizon has dry color of 10YR 4/2, 4/3, 5/3, 5/4, or 6/4 or of 7.5YR 4/4 or 5/6, and it has moist color of 10YR 3/2, 3/3, 3/4, 4/4, or 5/6 or of 7.5YR 3/2 or 4/4. The upper 6 inches of the B horizon has dry value of 4 or 5 and moist value or chroma, or both, of 3 or less. Clay content averages 27 to 35 percent and is

estimated to be 10 to 14 percent more than that in the A horizon. The B horizon averages 5 to 15 percent rock fragments, mainly in the lower part of the horizon.

The C horizon has dry color of 10YR 6/4 or 7/4 or of 7.5YR 6/6, and it has moist color of 10YR 4/4 or 5/4 or of 7.5YR 4/4. It averages 15 to 25 percent rock fragments.

Sandridge Series

The Sandridge series consists of very deep, somewhat excessively drained, alkali soils on basin rims. These soils formed in windblown alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 3 percent.

Soils of the Sandridge series are siliceous, thermic Typic Torripsamments.

Typical pedon of Sandridge loamy fine sand; about 7.2 miles south of Utica Avenue and 3.5 miles east of Interstate 5, about 100 feet south of a dirt road; 1,520 feet east and 1,720 feet south of the northwest corner of sec. 19, T. 24 S., R. 21 E.

A11—0 to 1 inch; grayish brown (2.5Y 5/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; weak medium platy structure; soft, very friable; many very fine roots; many very fine interstitial pores; broken shell fragments less than 0.5 millimeter in size; electrical conductivity is 0.6 millimho per centimeter; exchangeable sodium percentage is 1; slightly effervescent; slightly acid; abrupt smooth boundary.

A12—1 to 24 inches; light gray (2.5Y 7/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; many very fine roots; many very fine interstitial pores; broken shell fragments less than 0.5 millimeter in size; disseminated lime; electrical conductivity is 0.25 millimho per centimeter; exchangeable sodium percentage is 4; strongly effervescent; mildly alkaline; abrupt smooth boundary.

C—24 to 60 inches; light gray (5Y 7/1) loamy fine sand, olive gray (5Y 5/2) moist; massive; soft, very friable; few very fine roots; many very fine interstitial pores; broken shell fragments less than 0.5 millimeter in size; disseminated lime; electrical conductivity is 0.6 millimho per centimeter; exchangeable sodium percentage is 29; strongly effervescent; very strongly alkaline.

The part of the profile between depths of 12 and 35 inches is dry in all parts from March through December 1, and some or all parts of the profile are not moist for as long as 75 consecutive days. The soil is more than 60 inches deep. Organic matter content is less than 0.5 percent. The profile is effervescent throughout. Calcium carbonate content ranges from 1 to 5 percent. The profile is 1 to 3 percent shell fragments throughout. The profile typically is loamy fine sand, loamy sand, or sand.

The A horizon has dry color of 2.5Y 5/2, 7/2, or 7/1, and it has moist color of 2.5Y 3/2, 4/2, or 5/2. The reaction is slightly acid to strongly alkaline.

The C horizon has dry color of 5Y 7/1 or 2.5Y 7/1, and it has moist color of 5Y 5/2 or 2.5Y 5/2. Exchangeable sodium percentage is 15 to 50. The reaction ranges from moderately alkaline to very strongly alkaline.

Tulare Series

The Tulare series consists of very deep, somewhat poorly drained, saline-alkali soils in basins. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Tulare series are fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls.

Typical pedon of Tulare clay, partially drained; about 5 miles southwest of Corcoran; about 0.5 mile west of 10th Avenue and 100 feet north of Redding Avenue; about 2,640 feet west and 100 feet north of the southeast corner of sec. 12, T. 22 S., R. 21 E.

Ap1—0 to 0.25 inch; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; strong fine granular structure; very hard, friable, sticky and plastic; many very fine tubular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—0.25 inch to 16 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; common fine faint light brownish gray (10YR 6/2) mottles, grayish brown (10YR 5/2) moist; strong very coarse prismatic structure parting to strong coarse subangular blocky; very hard, friable, sticky and plastic; many very fine and common fine roots; many very fine tubular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

C1—16 to 31 inches; light gray (5Y 7/2) clay, dark gray (N 4/0) moist; common fine distinct olive brown (2.5Y 4/4, dry or moist) mottles; strong very coarse prismatic structure; hard, friable, sticky and plastic; common pressure faces; common very fine roots; common very fine tubular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

C2ca—31 to 48 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; common fine distinct olive brown (2.5Y 4/4, dry or moist) mottles; massive; hard, friable, sticky and plastic; common pressure faces; common very fine and few fine roots; common very fine tubular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3—48 to 60 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; hard,

friable, sticky and plastic; common pressure faces; few very fine tubular pores; violently effervescent; moderately alkaline.

The profile is saturated at some time of the year. The A horizon or mollic epipedon is 14 to 25 inches thick. Organic matter content is 2 to 3 percent in the A horizon and decreases irregularly with increasing depth. Calcium carbonate content is 15 to 25 percent throughout the profile and is dominantly disseminated, although thin layers of decomposed shell fragments are present at random depths. When the profile is dry late in summer, vertical cracks extend from the surface to a depth of 25 to 50 inches and are 2 to 5 inches wide. Pressure faces are at a depth of 25 to 40 inches.

The A horizon has dry color of 10YR 4/1 or 5/1 or of 5Y 4/1 or 5/1, and it has moist color of 10YR 3/1 or 3/2 or of 5Y 3/1. It has mottles in the lower part that have color of 10YR 3/1 or 5/2 or of 5YR 4/2 or 4/3.

The C horizon has dry color of 2.5Y 5/2 or of 5Y 5/1, 5/3, 6/1, 6/2, 7/1, or 7/2, and it has moist color of 2.5Y 3/2 or 4/2, of 5Y 4/1, 4/2, 4/3, 5/2, or 5/3, or of N 4/0. It has mottles that have color of 2.5Y 4/4 or of 5Y 2.5/2, 4/2, or 4/3. This horizon is dominantly clay or silty clay and averages 40 to 60 percent clay.

Tulare Variant

The Tulare Variant consists of very deep, poorly drained, saline-alkali soils on basin rims and flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Tulare Variant are very fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls.

Typical pedon of Tulare Variant clay, partially drained; about 0.5 mile north of Laurel Avenue and 0.75 mile west of 22nd Avenue; in the SE1/4SW1/4SW1/4 of sec. 12, T. 20 S., R. 19 E.

Ap1—0 to 2 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; strong fine subangular blocky structure; very hard, friable, very sticky and very plastic; many very fine and fine roots; few very fine tubular pores; few fine crystals of gypsum; disseminated lime; electrical conductivity is 16 millimhos per centimeter; exchangeable sodium percentage is 23; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—2 to 10 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; few fine prominent yellowish red (5YR 5/8) mottles, yellowish red (5YR 5/6) moist; strong very coarse prismatic structure; very hard, friable, very sticky and very plastic; many very fine and fine roots; many very fine tubular pores; few fine crystals of gypsum; disseminated lime; electrical conductivity is 21 millimhos per centimeter; exchangeable sodium percentage is 28; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1g—10 to 27 inches; mixed gray (5Y 5/1) and dark gray (5Y 4/1) clay, dark gray (5Y 4/1) and black (5Y 2.5/1) moist; common fine prominent strong brown (7.5YR 5/6) mottles, brown (7.5YR 4/4) moist; massive; extremely hard, friable, very sticky and very plastic; many very fine tubular pores; common fine crystals of gypsum; disseminated lime; electrical conductivity is 30 millimhos per centimeter; exchangeable sodium percentage is 36; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C2g—27 to 39 inches; mixed dark gray (5Y 5/1) and very dark gray (5Y 3/1) clay, olive gray (5Y 4/2) and black (5Y 2.5/1) moist; many medium prominent strong brown (7.5YR 5/6, dry or moist) mottles; massive; extremely hard, friable, very sticky and very plastic; few very fine tubular pores; few fine crystals of gypsum; disseminated lime; electrical conductivity is 25 millimhos per centimeter; exchangeable sodium percentage is 34; slightly effervescent; moderately alkaline; abrupt wavy boundary.

IIAbg—39 to 47 inches; mixed dark gray (5Y 4/1) and olive gray (5Y 5/2) clay, black (5Y 2.5/1) and olive gray (5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/4, dry or moist) mottles; massive; very hard, friable, very sticky and very plastic; common very fine tubular pores; disseminated lime; electrical conductivity is 18 millimhos per centimeter; exchangeable sodium percentage is 31; slightly effervescent; moderately alkaline; abrupt smooth boundary.

IIC3g—47 to 56 inches; light gray (5Y 6/1) clay, gray (5Y 5/1) moist; many medium prominent yellowish brown (10YR 5/6) mottles, brownish yellow (10YR 6/6) moist; massive; very hard, friable, very sticky and very plastic; few very fine tubular pores; electrical conductivity is 15.5 millimhos per centimeter; exchangeable sodium percentage is 27; moderately alkaline; abrupt smooth boundary.

IIIC4g—56 to 62 inches; light olive gray (5Y 6/2) fine sandy loam, olive gray (5Y 5/2) moist; many medium prominent brownish yellow (5Y 6/6) mottles, yellowish brown (10YR 5/6) moist; massive; hard, very friable, slightly sticky and slightly plastic; electrical conductivity is 17 millimhos per centimeter; exchangeable sodium percentage is 32; moderately alkaline.

The profile is saturated at some time of the year. Thickness of the mollic epipedon ranges from 10 to 14 inches. Organic matter content is 1 to 2 percent in the A horizon and decreases irregularly with increasing depth. Disseminated lime commonly is present from the surface to a depth of 40 inches, and it is present throughout the profile in some pedons. When the profile is dry, vertical

cracks extend from the surface to a depth of 20 to 30 inches and are 0.5 to 1 inch wide. Clay content of the 10- to 40-inch control section is 60 to 70 percent. Reaction is mildly alkaline or moderately alkaline. Electrical conductivity ranges from 8 to 30 millimhos per centimeter. The exchangeable sodium percentage ranges from 15 to 50.

Twisselman Series

The Twisselman series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Twisselman series are fine, mixed (calcareous), thermic Typic Torriorthents.

Typical pedon of Twisselman silty clay; 300 feet north of the Kern County line and 45 feet west of the road; 300 feet north and 45 feet west of the southeast corner of sec. 33, T. 24 S., R. 20 E.

Ap—0 to 9 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and very plastic; common very fine and few fine roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—9 to 19 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable, sticky and plastic; few very fine and common fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—19 to 60 inches; pale yellow (2.5Y 7/4) silty clay, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic; few very fine, fine, and coarse roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline.

The part of the profile between depths of 4 and 12 inches is usually not moist in some or all parts for as long as 70 to 90 consecutive days. It is usually dry from March or April to December or January. Organic matter content is less than 0.5 percent and decreases regularly with increasing depth. Lime commonly is disseminated; where it is segregated, however, it is present as filaments or threads. The profile is moderately alkaline or strongly alkaline. Clay content ranges from 40 to 60 percent.

Vanguard Series

The Vanguard series consists of very deep, poorly drained, saline-alkali soils on flood plains. These soils formed in alluvium derived dominantly from igneous rock. Slope ranges from 0 to 1 percent.

Soils of the Vanguard series are coarse-loamy, mixed (calcareous), thermic Typic Halaquepts.

Typical pedon of Vanguard sandy loam, partially drained; about 0.25 mile south of Grangeville Boulevard. and 30 feet west of 24th Avenue; in the NE1/4NE1/4NE1/4 of sec. 27, T. 18 S., R. 19 E.

Ap—0 to 6 inches; dark gray (5Y 4/1) sandy loam, very dark gray (5Y 3/1) moist; weak and moderate medium subangular blocky structure; very hard, friable, slightly sticky and plastic; common very fine roots; few fine tubular pores and few very fine interstitial pores; electrical conductivity is 22 millimhos per centimeter; exchangeable sodium percentage is 46; strongly alkaline; abrupt wavy boundary.

A12—6 to 16 inches; grayish brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; common fine and very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 15 millimhos per centimeter; exchangeable sodium percentage is 30; slightly effervescent; moderately alkaline; clear wavy boundary.

C1—16 to 20 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 7.5 millimhos per centimeter; exchangeable sodium percentage is 45; slightly effervescent; moderately alkaline; clear smooth boundary.

IIC2—20 to 28 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine tubular pores and many very fine interstitial pores; electrical conductivity is 5 millimhos per centimeter; exchangeable sodium percentage is 42; moderately alkaline; abrupt smooth boundary.

IIIAb—28 to 34 inches; gray (5Y 6/1) loam, very dark gray (5Y 3/1) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; many fine and very fine tubular pores; electrical conductivity is 4 millimhos per centimeter; exchangeable sodium percentage is 36; strongly alkaline; abrupt wavy boundary.

IVC3—34 to 60 inches; light olive gray (5Y 6/2) sandy clay loam, olive gray (5Y 4/2) moist; many fine distinct olive (5Y 5/4) mottles, olive (5Y 5/6) moist; massive; hard, firm, sticky and plastic; many fine and very fine tubular pores; disseminated lime; electrical

conductivity is 3 millimhos per centimeter; exchangeable sodium percentage is 37; slightly effervescent; strongly alkaline.

The profile is saturated at some time of the year. Organic matter content is 1 to 2 percent in the A horizon and decreases irregularly with increasing depth. Electrical conductivity of the saturation extract ranges from 4 to 25 millimhos per centimeter. Exchangeable sodium percentage ranges from 15 to 50. The exchangeable sodium percentage decreases with depth. It is moderately alkaline to very strongly alkaline.

The A horizon has dry color of 2.5Y 5/2 or of 5Y 4/1 or 4/2, and it has moist color of 2.5Y 3/2 or of 5Y 3/1 or 2/2.

The C horizon has dry color of 10YR 5/2, of 2.5Y 6/2 or 5/2, or of 5Y 6/1, 6/2, or 5/2, and it has moist color of 10YR 3/2, of 2.5Y 4/2 or 3/2, or of 5Y 4/2 or 3/1. Dark colors extend to a depth of less than 20 inches. Few to common mottles are in the lower part of the C horizon. This horizon has stratified layers of fine sandy loam, silt loam, loam, and sandy clay loam in the lower part.

Vaquero Series

The Vaquero series consists of moderately deep, well drained soils on hills and mountains. These soils formed in residuum derived dominantly from shale. Slope ranges from 15 to 75 percent.

Soils of the Vaquero series are fine, montmorillonitic, thermic Entic Chromoxererts.

Typical pedon of a Vaquero clay in an area of Vaquero and Altamont clays, 15 to 50 percent slopes; 2.75 miles northwest of Highway 41 via Stoker Canyon Road, about 50 feet east of the airstrip; 1,900 feet east and 200 feet south of the center of sec. 36, T. 24 S., R. 16 E.

A11—0 to 1 inch; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; strong medium subangular blocky structure parting to strong very fine subangular blocky; very hard, very friable, sticky and very plastic; many very fine roots; common very fine tubular pores; common intersecting slickensides; disseminated lime; slightly effervescent; neutral; abrupt wavy boundary.

A12—1 to 11 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium subangular blocky structure; very hard, very friable, sticky and very plastic; many very fine roots; common very fine tubular pores; common intersecting slickensides; disseminated lime; slightly effervescent; mildly alkaline; abrupt smooth boundary.

A13—11 to 17 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium subangular blocky structure; extremely hard, very friable, sticky and very plastic; many very fine roots; common very fine tubular pores; common intersecting slickensides; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—17 to 25 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; strong medium subangular blocky structure; extremely hard, friable, sticky and very plastic; many very fine roots; common very fine tubular pores; common intersecting slickensides; lime is disseminated and in common medium irregularly shaped soft masses and seams; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—25 to 36 inches; variegated brown (10YR 5/3), brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) clay, brown (10YR 4/3), yellowish brown (10YR 5/6), and dark yellowish brown (10YR 4/6) moist; strong medium subangular blocky structure; extremely hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; common intersecting slickensides; lime is disseminated and in common medium irregularly shaped soft masses, filaments, and seams; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3r—36 inches; variegated brown (10YR 5/3), yellowish brown (10YR 5/6), brownish yellow (10YR 6/6), and gray (10YR 5/1) highly fractured calcareous shale with soil in the fractures; lime is disseminated and in many medium irregularly shaped soft masses, concretions, and filaments; violently effervescent; strongly alkaline.

Depth to paralithic contact of shale ranges from 20 to 40 inches. Vertical cracks extend from the surface and are 0.5 to 3 inches wide at a depth of 20 inches. The cracks usually close from December through April for 100 to 150 consecutive days. Few to many intersecting slickensides are below a depth of 10 inches.

The A horizon has dry color of 10YR 5/2, 5/3, 5/4, 6/2, or 6/3 or of 2.5Y 5/2 or 6/2, and it has moist color of 10YR 4/2 or 4/3 or of 2.5Y 4/2, 4/4, or 5/4. It is slightly effervescent to violently effervescent. Lime is disseminated or is in common fine soft masses. The calcium carbonate equivalent ranges from 1 to 2 percent. The profile is neutral to moderately alkaline.

The C horizon has dry color of 10YR 5/3, 5/6, 6/3, 6/4, or 6/6 or of 2.5Y 6/2 or 7/4, and it has moist color of 10YR 4/3, 4/6, 5/4, 5/6, 6/6, or 6/8 or of 2.5Y 4/4 or 7/4. Mottles with moist color of 7.5YR 5/8 or 10YR 3/3 are none to common. The horizon commonly is clay, but in some pedons it is silty clay. The calcium carbonate equivalent ranges from 1 to 3 percent. The horizon typically is alkali in some part, and in some areas it is saline-alkali. It is moderately alkaline or strongly alkaline.

Wadesprings Series

The Wadesprings series consists of moderately deep, well drained soils on hills and mountains. These soils formed in residuum derived dominantly from serpentine, talc, and asbestos. Slope ranges from 15 to 75 percent.

Soils of the Wadesprings series are fine-loamy, serpentinitic, thermic Pachic Argixerolls.

Typical pedon of Wadesprings stony loam, 15 to 50 percent slopes; in a roadbank about 0.3 mile east of the Dawson Mine and 1 mile northeast of the Monterey County line, about 1,200 feet east and 200 feet south of the center of sec. 28, T. 23 S., R. 16 E.

A1—0 to 1 inch; gray (10YR 5/1) stony loam, very dark gray (10YR 3/1) moist; moderate thick platy structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores and common very fine tubular pores; 5 percent pebbles, 5 percent cobbles, and 5 percent stones; neutral; abrupt wavy boundary.

B21t—1 to 7 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; strong coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; common thin clay films in pores and on peds; 5 percent pebbles and 5 percent cobbles; mildly alkaline; abrupt wavy boundary.

B22t—7 to 18 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; strong coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine interstitial pores and many very fine and common fine tubular pores; common thin clay films in pores and on peds; 5 percent pebbles and 5 percent cobbles; moderately alkaline; clear wavy boundary.

B3t—18 to 31 inches; gray (10YR 5/1) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; common very fine roots; many very fine interstitial pores and common very fine and fine tubular pores; few thin clay films in pores; 10 percent pebbles and 20 percent angular cobbles; moderately alkaline; clear wavy boundary.

Cr—31 inches; variegated light bluish gray (5B 7/1), gray (10YR 5/1), and yellow (10YR 7/6) highly weathered and fractured talc and asbestos surrounding 30 percent serpentine cobbles; common very fine roots in fractures; lime is disseminated and in few fine seams; strongly effervescent; moderately alkaline.

Depth to paralithic contact composed of talc, asbestos, and serpentine ranges from 20 to 40 inches. Organic matter content ranges from 1 to 3 percent to a depth of more than 20 inches. The part of the profile between depths of 5 and 13 inches is moist in some part from mid-December through May. It is usually dry in all parts from June 1 to November 1.

The A and B2t horizons have dry color of 10YR 5/1 or 4/1. Rock fragment content ranges from 5 to 15 percent.

The B3t horizon has dry color of 10YR 5/1 or 4/1, and it has moist color of 10YR 3/1 or 3/2. Rock fragment content ranges from 15 to 35 percent. The profile is mildly alkaline or moderately alkaline.

Wasco Series

The Wasco series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from sandstone. Slope ranges from 0 to 5 percent.

Soils of the Wasco series are coarse-loamy, mixed, nonacid, thermic Typic Torriorthents.

Typical pedon of Wasco sandy loam, 0 to 5 percent slopes; about 2 miles southeast of the city of Avenal, just west of the cattle pen next to the road; in the SE1/4SW1/4SE1/4 of sec. 26, T. 22 S., R. 17 E.

A11—0 to 1 inch; grayish brown (2.5Y 5/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores; slightly acid; abrupt smooth boundary.

A12—1 to 7 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; neutral; abrupt smooth boundary.

A13—7 to 20 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine interstitial pores and common very fine tubular pores; mildly alkaline; abrupt smooth boundary.

C—20 to 60 inches; light olive brown (2.5Y 5/4) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; loose, very friable, nonsticky and nonplastic; common fine roots; common very fine tubular pores; disseminated lime; slightly effervescent; mildly alkaline.

The part of the profile between depths of 8 and 24 inches is dry in all parts from mid-April until mid-January and is only continuously moist in some parts for 60 to 90 consecutive days in winter. Organic matter content is less than 0.5 percent and decreases regularly with increasing depth. The horizon is neutral to moderately alkaline.

The C horizon has moist color of 2.5Y 5/4, 5/2, or 6/2. It commonly is sandy loam, but in some areas it is fine sandy loam.

Westcamp Series

The Westcamp series consists of very deep, somewhat poorly drained, saline-alkali soils on basin rims and flood plains. These soils formed in alluvium derived dominantly from sedimentary and igneous rock. Slope ranges from 0 to 2 percent.

Soils of the Westcamp series are fine-silty, mixed (calcareous), thermic Aeric Fluvaquents.

Typical pedon of Westcamp loam, partially drained; about 100 feet north of Quail Avenue and 0.2 mile west of Highway 41; 1,650 feet east and 100 feet north of the southwest corner of sec. 6, T. 22 S., R. 19 E.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine interstitial pores; disseminated lime; electrical conductivity is 3 millimhos per centimeter; exchangeable sodium percentage is 4; strongly effervescent; mildly alkaline; abrupt smooth boundary.

A12—7 to 10 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and slightly plastic; many very fine and common fine roots; few very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 2.7 millimhos per centimeter; exchangeable sodium percentage is 9; strongly effervescent; moderately alkaline; abrupt smooth boundary.

IIC1—10 to 14 inches; light yellowish brown (2.5Y 6/4) silt loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct light gray (5Y 7/1) mottles and few fine distinct yellow (10YR 7/6) mottles, gray (5Y 5/1) and yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, sticky and slightly plastic; many very fine and few fine roots; few very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 3.8 millimhos per centimeter; exchangeable sodium percentage is 12; strongly effervescent; moderately alkaline; abrupt smooth boundary.

IIIC2g—14 to 20 inches; pale yellow (2.5Y 7/4) silt loam, olive brown (2.5Y 4/4) moist; many medium distinct light gray (5Y 7/1) mottles, dark gray (5Y 4/1) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine and fine roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; electrical conductivity is 3.1 millimhos per centimeter; exchangeable sodium percentage is 32; slightly effervescent; strongly alkaline; abrupt smooth boundary.

IVC3gca—20 to 26 inches; variegated light gray (2.5Y 7/2 and 5Y 7/1) silty clay loam with many thin strata of silt loam, dark grayish brown (2.5Y 4/2) and gray (5Y 5/1) moist; many medium distinct yellow (10YR 7/6) mottles, yellowish brown (10YR 5/4) moist; massive; hard, firm, very sticky and very plastic; few very fine roots; many very fine tubular pores and common very fine interstitial pores; lime is disseminated and in common fine soft masses; electrical conductivity is 4.7 millimhos per centimeter; exchangeable sodium percentage is 44; violently effervescent; strongly alkaline; abrupt smooth boundary.

VC4gca—26 to 37 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; many fine distinct light gray (5Y 7/1) mottles, dark gray (5Y 4/1) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; many very fine tubular and interstitial pores; disseminated lime; electrical conductivity is 27 millimhos per centimeter; exchangeable sodium percentage is 59; slightly effervescent; moderately alkaline; abrupt smooth boundary.

VIC5gsa—37 to 58 inches; variegated light gray (2.5Y 7/2), white (5Y 8/1), and pale yellow (2.5Y 7/4) silty clay, grayish brown (2.5Y 5/2), gray (5Y 5/1), and light yellowish brown (2.5Y 6/4) moist; massive; extremely hard, firm, very sticky and very plastic; lime is disseminated and in common medium soft masses; electrical conductivity is 19 millimhos per centimeter; exchangeable sodium percentage is 53; violently effervescent; strongly alkaline; abrupt smooth boundary.

VIIC6gsacs—58 to 72 inches; light gray (5Y 7/1) clay, bluish gray (5B 5/1) moist—quickly oxidizes to gray (N 6/0, moist) when exposed to air; few fine prominent brownish yellow (10YR 6/6) mottles, dark yellowish brown (10YR 4/4) moist; massive; extremely hard, very firm, very sticky and very plastic; lime in few fine soft masses; common fine crystals of gypsum; electrical conductivity is 22 millimhos per centimeter; exchangeable sodium percentage is 57; slightly effervescent; moderately alkaline.

The profile is highly stratified. It is saturated, naturally free of dissolved oxygen, in a reduced state at some time of the year. Organic matter content is less than 1 percent at the surface and decreases irregularly with increasing depth.

The A horizon has dry color of 2.5Y 5/2, 6/2, or 6/4 or of 5Y 6/2, and it has moist color of 2.5Y 4/2 or 5/2 or of 5Y 4/1 or 4/2. It is mildly alkaline to very strongly alkaline. It is slightly effervescent to violently effervescent. The calcium carbonate equivalent ranges from 1 to 3 percent.

The C horizon has dry color of 10YR 7/3, of 2.5Y 4/2, 6/4, 7/2, or 7/4, of N 8/0 or 8/2, or of 5Y 4/1, 6/1, 6/2, 7/1, or 8/1, and it has moist color of 10YR 4/3, of 2.5Y 4/2, 4/4, 5/2, 6/2, 6/4, or 7/2, of 5Y 3/1, 3/2, 4/1, 4/3, 5/1, or 5/2, of 5GY 5/1, of N 6/0, or of 5B 5/1. Mottles

have moist color of 5YR 3/4 or 4/4, of 7.5YR 4/4 or 5/6, of 10YR 3/3, 4/4, 5/4, or 5/6, of 2.5Y 7/6, of 5Y 3/1, 4/1, or 5/1, of 5GY 5/1, or of N 5/0. More than 40 percent of the moist matrix colors at a depth of 10 to 30 inches have chroma of 3 or more where mottles are present. Chroma is 2 or 3 in pedons where no mottles are present. The C horizon ranges from fine sandy loam to clay, and the particle size control section is 18 to 35 percent clay and less than 15 percent sand that is fine or coarser. It is moderately alkaline to very strongly alkaline. The calcium carbonate equivalent ranges from 1 to 14 percent. Lime is disseminated or is segregated in soft masses and filaments.

Westhaven Series

The Westhaven series consists of very deep, moderately well drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 5 percent.

Soils of the Westhaven series are fine-silty, mixed (calcareous), thermic Typic Torrifluvents.

Typical pedon of Westhaven loam, 0 to 2 percent slopes; 2,600 feet south of Nevada Avenue and 250 feet west of 30th Avenue; 2,600 feet south and 250 feet west of the northeast corner of sec. 3, T. 21 S., R. 18 E.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; slightly hard, very friable, sticky and plastic; common very fine and few fine roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—7 to 19 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores and many very fine interstitial pores; disseminated lime; slightly effervescent; moderately alkaline; clear wavy boundary.

IIC2—19 to 24 inches; light brownish gray (2.5Y 6/2) silty clay loam with many thin strata of silty clay and silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine tubular and interstitial pores; lime is disseminated and in common fine irregularly shaped soft masses; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIIC3—24 to 29 inches; light brownish gray (2.5Y 6/2) silt loam with many thin strata of silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine prominent yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 3/6) moist; massive; slightly hard, very friable, sticky and plastic; few fine roots; many very fine tubular and interstitial pores; lime is disseminated and in common fine irregularly shaped soft masses; strongly effervescent; moderately alkaline; gradual wavy boundary.

IIIC4—29 to 45 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, sticky and plastic; few very fine roots; many very fine tubular and interstitial pores; disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

IVC5—45 to 72 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and very plastic; few very fine tubular pores; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

VC6—72 to 84 inches; light gray (2.5Y 7/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; loose; many very fine interstitial pores; mildly alkaline.

The profile between depths of 4 and 12 inches is dry in all parts from April through December and is not moist in some or all parts for as long as 90 consecutive days. The profile is mildly alkaline to strongly alkaline. It is noneffervescent to violently effervescent; however, lime is present in all pedons between depths of 10 and 20 inches. The lime is disseminated and in filaments or soft masses. Electrical conductivity ranges from 0.5 to 8 millimhos per centimeter, and the exchangeable sodium percentage is is 2 to 42.

The C horizon has dry color of 2.5Y 6/2 or 7/2 or of 5Y 6/3, and it has moist color of 2.5Y 4/2 or 5/2 or of 5Y 5/3. It has few or common, fine or medium, and distinct to prominent mottles and has moist color of 10YR 3/6 or 5/6. The horizon ranges from fine sandy loam to clay, and the particle-size control section commonly is 18 to 35 percent clay. The horizon is loamy sand to clay below a depth of 40 inches. Less than 15 percent of the particles are sand that is fine or coarser, by weighted average, between depths of 10 and 40 inches.

Whitewolf Series

The Whitewolf series consists of very deep, somewhat excessively drained soils on alluvial fans. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Whitewolf series are mixed, thermic Xeric Torripsamments.

Typical pedon of Whitewolf coarse sandy loam; about 2,100 feet north of Lacey Boulevard and 130 feet west of 16th Avenue; 2,100 feet north and 130 feet west of the southeast corner of sec. 25, T. 18 S., R. 20 E.

Ap—0 to 10 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2)

moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; common fine tubular pores; slightly acid; abrupt smooth boundary.

C—10 to 60 inches; white (2.5Y 8/2) sand, grayish brown (2.5Y 5/2) moist; massive; loose; many fine interstitial pores; slightly acid.

The part of the profile between depths of 12 and 22 inches is dry more than half the year. Organic matter content at a depth of 10 inches is less than 1 percent. The profile is neutral or slightly acid.

The A horizon has dry color of 10YR 5/2 or 5/3, and it has moist color of 10YR 3/2 or 3/3.

The C horizon has dry color of N 6/0 or 8/0 or of 2.5Y 8/2, and it has moist color of N 5/0, 6/0, or 7/0 or of 2.5Y 5/2.

Youd Series

The Youd series consists of shallow, somewhat poorly drained, saline-alkali soils on flood plains. These soils formed in alluvium derived dominantly from igneous and sedimentary rock. Slope ranges from 0 to 1 percent.

Soils of the Youd series are loamy, mixed, thermic, shallow Entic Durorthids.

Typical pedon of Youd fine sandy loam; about 50 feet south and 30 feet east of the intersection of Flint Avenue and 4th Avenue; 50 feet south and 30 feet east of the northwest corner of sec. 18, T. 18 S., R. 23 E.

Ap—0 to 10 inches; pale yellow (5Y 7/3) fine sandy loam, olive (5Y 5/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; lime is in common fine soft masses; electrical conductivity is 24 millimhos per centimeter; exchangeable sodium percentage is 45; slightly effervescent; medium acid; abrupt wavy boundary.

C1si—10 to 26 inches; pale yellow (5Y 7/3) duripan, olive (5Y 5/3) moist; common fine distinct light yellowish brown (10YR 6/4) mottles, brown (10YR 4/3) moist; massive; extremely hard, extremely firm; many very fine and fine continuous random tubular pores; many thick clay films in pores; lime is in few fine concretions; electrical conductivity is 3.5 millimhos per centimeter; exchangeable sodium percentage is 2; slightly effervescent; neutral; abrupt wavy boundary.

IIC2—26 to 34 inches; pale yellow (2.5Y 7/4) very fine sandy loam, olive brown (2.5Y 4/4) moist; common fine distinct brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine interstitial pores; electrical conductivity is 0.9 millimho per cubic centimeter; exchangeable sodium percentage is 4; neutral; abrupt smooth boundary.

IIIC3—34 to 60 inches; light gray (2.5Y 7/2) sand, grayish brown (2.5Y 5/2) moist; massive; slightly hard, loose; many very fine interstitial pores; electrical conductivity is 0.6 millimho per cubic centimeter; exchangeable sodium percentage is 11; neutral.

Depth to the duripan is 8 to 20 inches. The part of the profile between a depth of 8 inches and the duripan is dry in all parts from April 1 until December 1 and is usually not moist in some or all parts for as long as 90 consecutive days.

The A horizon has dry color of 5Y 7/2, 7/3, or 6/2, of 2.5Y 7/2 or 6/2, or of 10YR 7/3 or 7/4, and it has moist color of 5Y 5/2 or 5/3, of 2.5Y 5/2 or 4/2, or of 10YR 5/3 or 5/4. Clay content is 12 to 18 percent. The horizon is medium acid to neutral. It typically is saline-alkali.

The C1si horizon has dry color of 5Y 7/3, 7/2, or 7/1, and it has moist color of 5Y 6/2, 5/2, or 5/3. Mottles are few or common, and they have moist color of 10YR 5/4 or 4/3 or of 7.5YR 3/2. The horizon is 12 to 20 inches. The part of the C horizon below the C1si horizon has dry color of 2.5Y 7/2, 7/4, or 6/4 or of 10YR 7/4, and it has moist color of 2.5Y 6/2, 5/2, or 4/4 or of 10YR 5/4. Mottles are few or common, and they have moist color of 10YR 5/6 or 7.5YR 5/6. Texture ranges from sand to silt loam. In some pedons lime is present in the lower part of the C horizon. Reaction ranges from neutral to moderately alkaline. The C horizon is saline-alkali in some pedons.

Formation of the Soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Soil is the collection of natural bodies on the earth's surface. In places it is modified or even made by man of earthy material containing living matter and supporting or capable of supporting plants outdoors. It is a mixture of rocks and minerals, organic matter, water, and air, all of which occur in varying proportions. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) biological forces; (4) relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the parent material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place. The influence of each soil forming factor on the soils in the survey area is described in the pages that follow.

Parent Material

The parent material from which the soils in the survey area have developed is both transported and residual. The parent material is the weathered rock or unconsolidated material from which soils form. The hardness, grain size, porosity, and amount of salts in the parent material and its content of weatherable minerals greatly influence the formation of soils.

Transported parent material.— Recent alluvial deposits of many of the soils in the survey area are derived from parent material from the Sierra Nevada. They are dominantly weathered from igneous rock such as granite and gabbro and to a lesser extent from sedimentary rock such as sandstone. The granite is composed mainly of quartz and orthoclase (potassium) feldspar, with a lesser amount of mica and a small amount of hornblende (*5*). Gabbro is mainly composed of plagioclase (sodium and calcium) feldspar, augite, and hornblende. The Armona, Boggs, Cajon, Corona, Excelsior, Garces, Goldberg, Grangeville, Kimberlina, Lakeside, Lemoore, Nord, Vanguard, and Whitewolf soils formed in material derived from gabbro.

Older alluvial deposits derived from parent material from the Sierra Nevada have a hardpan or weakly cemented layer. The Melga, Remnoy, and Youd soils formed in this material.

Alluvial deposits on the west side of the San Joaquin Valley are derived from parent material in the hills and mountains on the west side of the valley. They dominantly are weathered from sedimentary rock such as sandstone and shale. The Avenal, Milham, Panoche, Parkfield Variant, Twisselman, Wasco, and Westhaven soils formed in this material.

The soils in the Tulare Lake basin and on the basin rim formed in alluvium derived from parent material in the Sierra Nevada and on the hills and mountains on the west side of the San Joaquin Valley. The Gepford, Homeland, Houser, Lethent, Pitco, Rambla, Sandridge, Tulare, Tulare Variant, and Westcamp soils formed in this material.

Residual parent material.—The parent material of most of the residual soils on the hills and mountains in the survey area weathered from sedimentary rock, mainly sandstone and shale. The sandstone contains more than 50 percent sand-sized particles, mainly of quartz, that are cemented together with silica, iron, or carbonates. The cementing material, together with "impurities" such as feldspar, influences the kind of soil that formed in material derived from sandstone. The shale is laminated or layered and somewhat indurated or hardened. In general, its mineral composition is of layer silicates, feldspar, quartz, a small amount of mica, and (in some places) calcium carbonate. The Altamont, Cantua, Carollo, Delgado, Gaviota, Kettleman, Kreyenhagen, Mercey, Millsholm, Reefridge, Sagaser, and Vaquero soils formed in material derived from sedimentary rock. The Henneke and Wadesprings soils formed in material derived from serpentine.

Climate

Climate has had a major influence on the formation of the soils in the survey area. Moisture and temperature influence the amount and kind of vegetation that grows, the rate at which minerals weather, and the removal of material from the different soil horizons or accumulation of material in them.

The summers are virtually rainless. The winters are cool, and most of the annual precipitation falls between December and March. By late in winter the soils are usually moist to a depth of several feet. By summer these same soils are very dry.

The rainfall increases from southwest to northeast in the survey area across the valley and from east to west in the hills and mountains. The average annual precipitation ranges from about 5 to 8 inches in the part of the survey area that is in the San Joaquin Valley. The average annual precipitation ranges from about 6 to 18 inches in the hills and mountains.

The air temperature varies considerably from the San Joaquin Valley to the mountains on the west side of Kings County. The average annual air temperature ranges from about 61 degrees F in the northeastern part of the county to about 65 degrees on the western edge of the San Joaquin Valley. The average air temperature decreases from about 65 degrees in the lower lying Kettleman Hills to about 59 degrees in the upper mountains.

Plant growth is rapid early in spring but ceases in May and June because of lack of moisture and increased air temperature. With increased elevation in the hills and mountains, however, plants continue to grow until later in summer because of increased precipitation and lower temperatures. On the upper part of the hills and mountains, vegetation is more abundant and generally the organic matter content of the soils is greater.

Biological Activity

The vegetation in the survey area has had more effect on the formation of soils than have other biological agents. Burrowing animals, insects, bacteria, and fungi are important, but their activity depends in large part upon the vegetation that grows on the soil. The main effects of vegetation results from the accumulation of organic matter in the surface layer and the penetration or roots into the surface layer and subsoil.

On the poorly drained flood plains in the area, the lush growth of vegetation provides the organic matter that produces the mollic epipedon of the Gepford soils.

The north-facing slopes of the hills and mountains are protected from direct sunlight. This shading effect increases the amount of water available to plants because it reduces evaporation. Because of this additional soil moisture, the soils on these slopes support a greater amount of grasses, forbs, shrubs, and hardwood trees. This vegetation adds organic matter and influences the color, structure, and physical condition of the soils. Sagaser soils are examples of soils that exhibit this effect. In contrast, the vegetation on the steep, south-facing slopes in some areas is very sparse. It provides little shade, returns little organic matter to the soil, and permits the soil to dry out faster and remain dry longer. The shallow Gaviota soils are on these exposed slopes.

In the hills and mountains, the plant cover is different because of the greater precipitation. Annual grasses and forbs are dominant on the lower hills. On the higher hills and mountains, these plants gradually give way to a mixture of annual grasses, forbs, shrubs, oaks, and Digger pines. Decomposition of the organic matter and the metabolism of plants produce acids that increase the rate of weathering. Leaf litter or duff also insulates the soil against heat and cold and reduces the rate of evaporation, which increases the length of time favorable for bacterial activity.

Time

The effect time has on soil formation in the survey area is evident in the degree of development and alteration of parent material by the interacting factors of climate, living organisms, and relief. As weathering and pedogenic processes proceed with time, the influence of the parent material is less and less. The position of soils on fans and stream terraces generally establishes their comparative age. The lowest stream bottoms generally consist of the most recent alluvium, and the highest stream terraces consist of the oldest alluvium.

The soils that formed in recent deposits of alluvium generally are deep and permeable. These soils generally do not exhibit horizon development, and some are stratified, which is evidence of recent flooding. Some recent alluvial soils are those of the Grangeville, Kimberlina, Panoche, and Whitewolf series.

Some alluvial soils considered to be older than the recently deposited soils are the Garces, Lethent, and Remnoy soils. These soils have at least on diagnostic horizon below the surface.

One of the oldest soils, the Parkfield Variant, is on high stream terraces. Because of its high position on the landscape, it is no longer susceptible to flooding and has been in place long enough to have a well developed profile. It has a clay enriched subsoil with a high content of montmorillonitic clay.

In the hills and mountains, most of the land surface has been subject to fairly steady geologic erosion. The effect of change in climate with increased elevation has had more influence on profile development than has time alone.

Relief

Relief influences soil formation primarily through its effect upon drainage, runoff, and water erosion and secondarily through variations in exposure to the sun and wind currents. The major differences in relief in the survey area are exemplified by three prominent physiographic units: (1) the alluvial fans and flood plains in the San Joaquin Valley; (2) the Tulare Lake basin and basin rim; and (3) the Kettleman Hills, Kreyenhagen Hills, and the Diablo Range.

Alluvial fans and flood plains cover areas along rivers and streams that extend into the San Joaquin Valley. They are nearly level to gently sloping and were formed by the deposition of soil material. The Cajon, Kimberlina,

Melga, Panoche, Twisselman, and Wasco soils are some of the soils on these alluvial fans and flood plains. The soils on these positions have less abundant vegetation because of limited soil moisture; therefore, they have a lower content of organic matter and a lighter colored surface layer. The lower lying, more nearly level areas on these positions receive additional soil moisture from a high water table. This has produced more abundant vegetation and accounts for the high organic matter content of the Grangeville soils.

The Gepford, Houser, and Tulare soils are some of the soils on the Tulare Lake basin or basin rim. These soils are clayey. They are at the lower elevations in the survey area, where fine textured igneous and sedimentary alluvium was deposited by rivers and streams.

The Cantua, Carollo, Delgado, Kettleman, Mercey, and Reefridge soils are in the Kettleman hills, the Kreyenhagen Hills, or other associated hills. These moderately sloping to steep soils have medium to rapid runoff. Material is eroded from the surface, which affects soil depth. The characteristics of the shallow Delgado soils and the moderately deep Mercey soils have been determined in part by their slope.

Aspect, or the direction a slope faces, becomes increasingly important in the hills and mountains of the Diablo Range. Sagaser soils generally are on north aspects which are cooler; therefore, these soils support more vegetation and thus have a dark-colored surface layer.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.5
Low	2.5 to 5.0
Moderate	5.0 to 7.5
High	7.5 to 10
Very high	More than 10

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or soil phases or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited for crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface for long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. These soils are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulfate. Commonly used to reclaim alkali (sodic) soils.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographic distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
Organic matter. Plant and animal residue in the soil in various stages of decomposition.
Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.
Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*
Parent material. The unconsolidated organic and mineral material in which soil forms.
Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.
Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.
Percolation. The downward movement of water through the soil.
Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.
Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.
pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)
Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.
Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.
Plastic limit. The moisture content at which a soil changes from semisolid to plastic.
Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.
Plowpan. A compacted layer formed in the soil directly below the plowed layer.
Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.
Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.
Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.
Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.
Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.
Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.
Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.
Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.
Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.
Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4

Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts (electrical conductivity of 4 millimhos per cubic centimeter or more at 25 Degrees C) in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

	Percent
Nearly level	0 to 2
Gently sloping	2 to 5
Moderately sloping	5 to 9
Strongly sloping	9 to 15
Moderately steep	15 to 30
Steep	30 to 50
Very steep	50 and higher than 75

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below the A horizon.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--AIR TEMPERATURE AND PRECIPITATION

[Recorded in the period 1948-73]

Month	Air Temperature Maximum	Air Temperature Minimum	Air Temperature Average	Precipitation
KETTLEMAN STATION				
	°F	°F	°F	In
January	55.1	38.4	46.7	1.31
February	61.9	43.3	52.6	1.20
March	67.6	45.7	56.6	0.80
April	75.5	50.4	62.9	0.63
May	84.3	56.3	70.3	0.27
June	93.2	63.4	78.3	0.02
July	100.1	69.8	84.9	0.02
August	97.8	68.2	83.0	0.05
September	91.2	63.5	77.4	0.04
October	80.4	56.1	68.3	0.24
November	66.7	47.1	56.9	0.83
December	55.6	39.6	47.6	0.81
Annual	---	---	65.5	6.23
HANFORD STATION				
	°F	°F	°F	In
January	55.2	34.5	44.8	1.54
February	61.9	37.6	49.8	1.59
March	67.6	40.3	53.9	1.34
April	75.3	45.2	60.3	0.77
May	83.3	50.8	67.1	0.23
June	90.8	56.6	73.8	0.07
July	97.4	61.2	79.3	0.01
August	95.5	59.0	77.2	*
September	90.3	54.3	72.3	0.05
October	80.5	46.1	63.3	0.37
November	66.7	38.4	52.6	0.68
December	55.1	34.7	44.9	1.47
Annual	---	---	61.6	8.12

*Trace

TABLE 2.--PROBABILITY OF RECEIVING LESS THAN THE INDICATED ANNUAL PRECIPITATION

[Recorded in the period 1948-73]

Station	Probability (percentage)								
	5	10	25	33	50	67	75	90	95
	In	In	In	In	In	In	In	In	In
Hanford------	3.97	4.11	5.18	5.21	6.88	7.73	8.14	10.45	11.62
Kettleman----	3.03	3.57	4.42	4.44	4.90	6.30	7.07	7.93	11.09

TABLE 3.--PROBABILITY OF FREEZING TEMPERATURES AFTER GIVEN DATES IN SPRING AND BEFORE GIVEN DATES IN FALL

Station	°F*	Percentage in spring									Percentage in fall								
		10	20	30	40	50	60	70	80	90	10	20	30	40	50	60	70	80	90
Hanford----	32	4/7	4/1	3/24	3/12	3/10	3/8	3/5	3/1	2/19	10/24	10/30	11/12	11/15	11/17	11/19	11/23	11/29	12/2
	28	3/4	3/2	3/1	2/17	2/16	2/8	1/28	1/22	11/14	11/17	11/18	11/19	11/25	12/2	12/6	12/7	12/14	12/28
Kettleman--	32	3/3	2/27	2/12	2/3	2/2	1/27	1/20	1/16	1/5	12/5	12/9	12/10	12/12	12/14	12/15	12/23	12/26	**
	28	2/27	1/31	1/20	1/9	1/6	1/3	1/1	**	**	12/11	12/15	12/21	12/24	12/27	**	**	**	**

*Temperature in degrees F at which killing frost is calculated to occur.
**Earlier than 1/1.
***Later than 12/31.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
101	Armona loam, partially drained	29,650	3.3
102	Avenal loam, 0 to 5 percent slopes	8,325	0.9
103	Boggs sandy loam, partially drained	4,213	0.5
104	Cajon sandy loam	3,913	0.4
105	Cantua coarse sandy loam, 5 to 15 percent slopes	7,620	0.9
106	Cantua coarse sandy loam, 15 to 30 percent slopes	1,900	0.2
107	Carollo clay loam, 5 to 20 percent	2,510	0.3
108	Corona silt loam	3,404	0.4
109	Delgado sandy loam, 5 to 15 percent slopes	17,121	1.9
110	Delgado sandy loam, 15 to 30 percent slopes	11,115	1.2
111	Delgado gravelly sandy loam, 15 to 30 percent slopes	6,538	0.7
112	Excelsior sandy loam	8,771	1.0
113	Garces loam	10,262	1.1
114	Gaviota-Rock outcrop complex, 50 to 75 percent slopes	11,127	1.2
115	Gepford clay, partially drained	29,644	3.3
116	Gepford clay, sandy substratum, partially drained	27,270	3.1
117	Goldberg loam, drained	5,873	0.7
118	Goldberg loam, partially drained	1,828	0.2
119	Grangeville sandy loam, saline-alkali	10,059	1.1
120	Grangeville fine sandy loam, partially drained	5,991	0.7
121	Grangeville fine sandy loam, saline-alkali, partially drained	6,665	0.7
122	Henneke very gravelly clay loam, 5 to 15 percent slopes	738	0.1
123	Henneke very gravelly clay loam, 15 to 50 percent slopes	1,465	0.2
124	Homeland fine sandy loam, partially drained	6,114	0.7
125	Houser fine sandy loam, drained	7,528	0.8
126	Houser clay, partially drained	21,697	2.4
127	Kettleman loam, 5 to 15 percent slopes	14,477	1.6
128	Kettleman loam, 15 to 30 percent slopes	7,600	0.9
129	Kettleman-Cantua complex, 30 to 50 percent slopes	27,979	3.1
130	Kimberlina fine sandy loam, saline-alkali	37,476	4.2
131	Kimberlina fine sandy loam, sandy substratum	11,129	1.2
132	Kimberlina saline-alkali-Garces complex	18,190	2.0
133	Kreyenhagen loam, 50 to 75 percent slopes	2,099	0.2
134	Lakeside loam, partially drained	12,182	1.4
135	Lakeside clay loam, drained	10,405	1.2
136	Lakeside clay, partially drained	1,582	0.2
137	Lemoore sandy loam, partially drained	5,474	0.6
138	Lethent fine sandy loam	4,904	0.5
139	Lethent clay loam	50,127	5.6
140	Melga silt loam	3,947	0.4
141	Mercey loam, 5 to 15 percent slopes	7,368	0.8
142	Mercey loam, 15 to 30 percent slopes	3,122	0.3
143	Mercey loam, 30 to 50 percent slopes	2,499	0.3
144	Milham sandy loam, silty substratum	5,386	0.6
145	Millsholm clay loam, 15 to 50 percent slopes	417	*
146	Millsholm clay loam, 50 to 75 percent slopes	1,573	0.2
147	Nord fine sandy loam	27,722	3.1
148	Nord fine sandy loam, saline-alkali	5,532	0.6
149	Nord complex	28,601	3.2
150	Panoche loam	36,399	4.1
151	Panoche clay loam, saline-alkali	11,298	1.3
152	Parkfield Variant gravelly clay loam, 2 to 8 percent slopes	1,556	0.2
153	Pitco clay, partially drained	3,392	0.4
154	Pits and Dumps	1,162	0.1
155	Rambla loamy sand, drained	8,968	1.0
156	Reefridge clay, 5 to 15 percent slopes	2,549	0.3
157	Reefridge clay, 15 to 30 percent slopes	2,772	0.3
158	Remnoy very fine sandy loam	5,577	0.6
159	Rock outcrop-Dystric Lithic Xerochrepts complex, 30 to 100 percent slopes	398	*
160	Rock outcrop-Lithic Torriorthents complex, 15 to 75 percent slopes	5,602	0.6
161	Sagaser loam, 50 to 75 percent slopes	2,792	0.3
162	Sandridge loamy fine sand	3,958	0.4
163	Tulare clay, partially drained	118,659	13.3
164	Tulare Variant clay, partially drained	648	0.1
165	Twisselman silty clay	2,019	0.2
166	Twisselman silty clay, saline-alkali	4,137	0.5

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
167	Urban land	10,581	1.2
168	Vanguard sandy loam, partially drained	9,615	1.1
169	Vaquero and Altamont clays, 15 to 50 percent slopes	9,126	1.0
170	Vaquero and Altamont clays, 50 to 75 percent slopes	1,809	0.2
171	Vaquero-Altamont-Millsholm complex, 15 to 50 percent slopes	1,545	0.2
172	Wadesprings stony loam, 15 to 50 percent slopes	1,064	0.1
173	Wadesprings stony loam, 50 to 75 percent slopes	992	0.1
174	Wasco sandy loam, 0 to 5 percent slopes	28,993	3.2
175	Westcamp loam, partially drained	34,845	3.9
176	Westhaven loam, 0 to 2 percent slopes	7,489	0.8
177	Westhaven loam, 2 to 5 percent slopes	1,040	0.1
178	Westhaven clay loam, saline-alkali, 0 to 2 percent slopes	10,351	1.2
179	Whitewolf coarse sandy loam	3,500	0.4
180	Youd fine sandy loam	3,245	0.4
	Water	15,587	1.7
	Total	892,800	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF IRRIGATED CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited for crops are listed]

Soil name and map symbol	Cotton lint	Barley	Safflower	Alfalfa hay	Almonds	Walnuts	Pistachios
	Lbs	Cwt	Tons	Tons	Lbs	Tons	Tons
101 Armona	750	24	1.0	---	---	---	---
102 Avenal	1,000	39	---	8	1,800	---	1.1
103 Boggs	600	20	---	---	---	---	---
104 Cajon	---	---	---	---	1,600	0.8	---
105 Cantua	700	19	---	---	---	---	---
108 Corona	1,000	39	---	8	2,300	1.7	1.3
112 Excelsior	900	33	---	5.5	---	---	---
113 Garces	960	38	---	8	---	---	---
115 Gepford	750	24	1.0	---	---	---	---
116 Gepford	800	26	1.0	---	---	---	---
117 Goldberg	900	28	1.0	---	---	---	---
118 Goldberg	750	24	1.0	---	---	---	---
119 Grangeville	1,000	36	1.0	6	---	---	---
120 Grangeville	1,000	36	1.2	8	1,800	1.7	1.1
121 Grangeville	1,000	36	1.0	7	---	---	---
124 Homeland	600	23	---	---	---	---	---
125 Houser	1,000	33	1.2	---	---	---	---
126 Houser	900	28	1.2	---	---	---	---
127 Kettleman	---	19	---	---	---	---	---
130 Kimberlina	1,000	33	---	7	---	---	---
131 Kimberlina	1,150	36	---	9	1,600	1.3	1.2

TABLE 5.--YIELDS PER ACRE OF IRRIGATED CROPS--Continued

Soil name and map symbol	Cotton lint	Barley	Safflower	Alfalfa hay	Almonds	Walnuts	Pistachios
	Lbs	Cwt	Tons	Tons	Lbs	Tons	Tons
132---------------------- Kimberlina-Garces	984	36	---	7	---	---	---
134---------------------- Lakeside	900	29	0.7	6	---	---	---
135---------------------- Lakeside	1,250	35	1.0	8	---	---	---
136---------------------- Lakeside	900	29	0.7	6	---	---	---
137---------------------- Lemoore	900	31	0.7	---	---	---	---
138, 139----------------- Lethent	1,000	33	1.2	---	---	---	---
140---------------------- Melga	600	24	---	---	---	---	---
144---------------------- Milham	1,125	38	---	8	1,900	---	1.1
147---------------------- Nord	1,000	39	---	8	2,300	1.7	1.3
148---------------------- Nord	1,000	39	---	7	---	---	---
149---------------------- Nord-Nord	1,000	40	---	7	---	---	---
150---------------------- Panoche	1,300	38	1.5	9	2,300	---	1.3
151---------------------- Panoche	1,250	38	1.5	8	---	---	---
153---------------------- Pitco	1,100	33	1.0	---	---	---	---
155---------------------- Rambla	900	33	---	---	---	---	---
158---------------------- Remnoy	500	19	---	---	---	---	---
162---------------------- Sandridge	350	19	---	---	---	---	---
163---------------------- Tulare	1,250	49	1.5	10	---	---	---
164---------------------- Tulare Variant	500	21	---	---	---	---	---
165---------------------- Twisselman	1,250	48	---	10	2,000	---	1.2
166---------------------- Twisselman	900	36	---	---	---	---	---
168---------------------- Vanguard	800	28	---	---	---	---	---

TABLE 5.--YIELDS PER ACRE OF IRRIGATED CROPS--Continued

Soil name and map symbol	Cotton lint	Barley	Safflower	Alfalfa hay	Almonds	Walnuts	Pistachios
	Lbs	Cwt	Tons	Tons	Lbs	Tons	Tons
174 Wasco	1,125	36	---	8	2,000	---	1.3
175 Westcamp	900	33	1.0	---	---	---	---
176 Westhaven	1,300	38	---	9	1,800	---	1.1
177 Westhaven	1,200	38	---	9	1,800	---	1.0
178 Westhaven	1,300	38	1.4	8	---	---	---
179 Whitewolf	900	28	---	6	---	0.8	---
180 Youd	600	24	---	---	---	---	---

TABLE 6.--STORIE INDEX RATING FOR SOILS

[The symbol < means less than. Absence of an entry indicates that the soil was not rated or that the soil rating was included in the map unit rating. The miscellaneous areas were given a rating for index and grade only]

Map symbol	Map unit name	Rating factors A	Rating factors B	Rating factors C	Rating factors X	Index	Grade	Limitations in X factor
101	Armona loam, partially drained	95	100	100	55x40	21	4	Drainage, saline-alkali.
102	Avenal loam, 0 to 5 percent slopes	95	100	95	100	90	1	None.
103	Boggs sandy loam, partially drained	100	95	100	70x20	13	5	Drainage, saline-alkali.
104	Cajon sandy loam	80	95	100	100	76	2	None.
105	Cantua coarse sandy loam, 5 to 15 percent slopes	90	80	90	100	73	2	None.
106	Cantua coarse sandy loam, 15 to 30 percent slopes	90	80	70	100	50	3	None.
107	Carollo clay loam, 5 to 20 percent slopes	40	80	80	50	13	5	Saline-alkali.
108	Corona silt loam	85	100	100	100	85	1	None.
109	Delgado sandy loam, 5 to 15 percent slopes	30	95	90	100	26	4	None.
110	Delgado sandy loam, 15 to 30 percent slopes	30	95	70	100	20	4	None.
111	Delgado gravelly sandy loam, 15 to 30 percent slopes	30	60	70	100	13	5	None.
112	Excelsior sandy loam	95	95	100	60	54	3	Saline-alkali.
113	Garces loam	85	100	100	40	34	4	Saline-alkali.
114	Gaviota-Rock outcrop complex, 50 to 75 percent slopes					4	6	
	Gaviota part	35	60	20	100			None.
	Rock outcrop part.							
115	Gepford clay, partially drained	90	60	100	50x40	11	5	Flooding-drainage, saline-alkali.
116	Gepford clay, sandy substratum, partially drained	85	60	100	50x40	10	5	Flooding-drainage, saline-alkali.
117	Goldberg loam, drained	80	100	100	90x70	50	3	Flooding, saline-alkali.
118	Goldberg loam, partially drained	80	100	100	65x70	36	4	Flooding-drainage, saline-alkali.
119	Grangeville sandy loam, saline-alkali	100	95	100	65x60	37	4	Flooding-drainage, saline-alkali.

TABLE 6.--STORIE INDEX RATING FOR SOILS--Continued

Map symbol	Map unit name	Rating factors A	B	C	X	Index	Grade	Limitations in X factor
120	Grangeville fine sandy loam, partially drained	100	100	100	80	80	1	Drainage.
121	Grangeville fine sandy loam, saline-alkali, partially drained	100	100	100	80x60	48	3	Drainage, saline-alkali.
122	Henneke very gravelly clay loam, 5 to 15 percent slopes	20	40	90	90	6	6	Nutrient level.
123	Henneke very gravelly clay loam, 15 to 50 percent slopes	20	40	50	90	4	6	Nutrient level.
124	Homeland fine sandy loam, partially drained	90	100	100	45x40	16	5	Flooding-drainage, saline-alkali.
125	Houser fine sandy loam, drained	90	100	100	75x40	28	4	Flooding, saline-alkali.
126	Houser clay, partially drained	90	60	100	65x40	14	5	Flooding-drainage, saline-alkali.
127	Kettleman loam, 5 to 15 percent slopes	70	100	90	100	63	2	None.
128	Kettleman loam, 15 to 30 percent slopes	65	100	70	100	45	3	None.
129	Kettleman-Cantua complex, 30 to 50 percent slopes					21*	4	None.
	Kettleman part	70	100	30	100			
	Cantua part	90	80	30	100			
130	Kimberlina fine sandy loam, saline-alkali	100	100	100	60	60	2	Saline-alkali.
131	Kimberlina fine sandy loam, sandy substratum	95	100	100	100	95	1	None.
132	Kimberlina, saline-alkali-Garces complex					47*	3	Saline-alkali.
	Kimberlina, saline-alkali, part	100	100	100	68			
	Garces part	85	100	100	40			
133	Kreyenhagen loam, 50 to 75 percent slopes	90	90	20	100	16	5	None.
134	Lakeside loam, partially drained	100	100	100	90x40	36	4	Saline-alkali.
135	Lakeside clay loam, drained	100	85	100	40	34	4	Saline-alkali.
136	Lakeside clay, partially drained	100	60	100	40	24	4	Saline-alkali.
137	Lemoore sandy loam, partially drained	100	95	100	70x70	46	3	Drainage, saline-alkali.

TABLE 6.--STORIE INDEX RATING FOR SOILS--Continued

Map symbol	Map unit name	Rating factors A	Rating factors B	Rating factors C	Rating factors X	Index	Grade	Limitations in X factor
138	Lethent fine sandy loam	80	100	100	60	48	3	Saline-alkali.
139	Lethent clay loam	80	85	100	60	41	3	Saline-alkali.
140	Melga silt loam	30	100	100	40	12	5	Saline-alkali.
141	Mercey loam, 5 to 15 percent slopes	50	90	90	100	40	3	None.
142	Mercey loam, 15 to 30 percent slopes	50	90	70	100	31	4	None.
143	Mercey loam, 30 to 50 percent slopes	50	90	40	100	18	5	None.
144	Milham sandy loam, silty substratum	80	95	100	100	76	2	None.
145	Millsholm clay loam, 15 to 50 percent slopes	40	85	55	95	18	5	Nutrient level.
146	Millsholm clay loam, 50 to 75 percent slopes	40	85	20	95	6	6	Nutrient level.
147	Nord fine sandy loam	100	100	100	100	1	1	None.
148	Nord fine sandy loam, saline-alkali	100	100	100	60	2		Saline-alkali.
149	Nord complex	100	100	100	82	82	1	Saline-alkali.
150	Panoche loam	100	100	100	100	100	1	None.
151	Panoche clay loam, saline-alkali	100	100	100	60	60	2	Saline-alkali.
152	Parkfield Variant gravelly clay loam, 2 to 8 percent slopes	65	70	95	100	43	3	None.
153	Pitco clay, partially drained	70	50	100	90x60	19	5	Drainage, saline-alkali.
154	Pits and Dumps					<10	6	
155	Rambla loamy sand, drained	80	80	100	80	51	3	Saline-alkali.
156	Reefridge clay, 5 to 15 percent slopes	90	60	90	80	39	4	Salinity.
157	Reefridge clay, 15 to 30 percent slopes	95	60	70	85	34	4	Salinity.
158	Remnoy very fine sandy loam	25	100	100	90x40	11	5	Flooding, saline-alkali.
159	Rock outcrop-Dystric Lithic Xerochrepts complex, 30 to 100 percent slopes					<10	6	
	Rock outcrop part.							
	Dystric Lithic Xerochrepts part.							

TABLE 6.--STORIE INDEX RATING FOR SOILS--Continued

Map symbol	Map unit name	Rating factors				Index	Grade	Limitations in X factor
		A	B	C	X			
160	Rock outcrop-Lithic Torriorthents complex, 15 to 75 percent slopes					<10	6	
	Rock outcrop part.							
	Lithic Torriorthents part.							
161	Sagaser loam, 50 to 75 percent slopes	85	100	20	95	16	5	Nutrient level.
162	Sandridge loamy fine sand	95	85	95	80	61	2	Saline-alkali.
163	Tulare clay, partially drained	70	60	100	65x80	22	4	Flooding-drainage.
164	Tulare Variant clay, partially drained	70	60	100	60x40	10	5	Drainage, saline-alkali.
165	Twisselman silty clay	80	70	100	100	56	3	None.
166	Twisselman silty clay, saline-alkali	80	70	100	90x40	20	4	Flooding, saline-alkali.
167	Urban land					<10	6	
168	Vanguard sandy loam, partially drained	100	95	100	45x40	17	5	Flooding-drainage, saline-alkali.
169	Vaquero and Altamont clays, 15 to 50 percent slopes						5	None.
	Vaquero part	50	55	50	100	14		
	Altamont part	70	55	50	100	19		
170	Vaquero and Altamont clays, 50 to 75 percent slopes						6	None.
	Vaquero part	50	55	20	100	5		
	Altamont part	70	55	20	100	8		
171	Vaquero-Altamont-Millsholm complex, 15 to 50 percent slopes					16*	5	Nutrient level.
	Vaquero part	50	55	50	100			
	Altamont part	70	55	50	100			
	Millsholm part	40	85	50	95			
172	Wadesprings stony loam, 15 to 50 percent slopes	60	70	45	100	19	5	None.

TABLE 6.--STORIE INDEX RATING FOR SOILS--Continued

Map symbol	Map unit name	Rating factors A	B	C	X	Index	Grade	Limitations in X factor
173	Wadesprings stony loam, 50 to 75 percent slopes-----	60	70	20	100	8	6	None.
174	Wasco sandy loam, 0 to 5 percent slopes-------------	100	95	95	100	81	1	None.
175	Westcamp loam, partially drained--------------------	90	100	100	90x60	49	3	Drainage, saline-alkali.
176	Westhaven loam, 0 to 2 percent slopes---------------	95	100	100	100	95	1	None.
177	Westhaven loam, 2 to 5 percent slopes---------------	95	100	95	100	90	1	None.
178	Westhaven clay loam, saline-alkali, 0 to 2 percent slopes-------------------------------------	95	85	100	80	65	2	Saline-alkali.
179	Whitewolf coarse sandy loam-------------------------	90	70	100	95	60	2	Nutrient level.
180	Youd fine sandy loam--------------------------------	20	100	100	80	16	5	Saline-alkali.

*Weighted value.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
102 Avenal	Loamy (17g)	Favorable	3,000	Red brome	30
		Normal	2,000	Foxtail fescue	20
		Unfavorable	1,000	Filaree	15
				Foxtail barley	5
				Soft chess	5
				Clover	5
				Pepperweed	5
				Allscale saltbush	5
105, 106 Cantua	Loamy (15g)	Favorable	2,800	Red brome	50
		Normal	1,800	Fescue	15
		Unfavorable	700	Filaree	5
				Soft chess	5
				Allscale saltbush	5
				Clover	5
107 Carollo	Fine Loamy Saline-Alkali (15g)	Favorable	2,800	Red brome	50
		Normal	1,800	Fescue	10
		Unfavorable	400	Allscale saltbush	10
				Barley	5
				Clover	5
				Filaree	5
				Soft chess	5
109, 110 Delgado	Shallow Loamy (15g)	Favorable	2,300	Red brome	50
		Normal	1,500	Foxtail fescue	20
		Unfavorable	400	Clover	5
				Filaree	5
				Allscale saltbush	5
111 Delgado	Shallow Loamy (15g)	Favorable	2,300	Red brome	35
		Normal	1,000	Foxtail fescue	30
		Unfavorable	400	Allscale saltbush	10
				Clover	5
				Ripgut brome	5
				Filaree	5
114*:					
Gaviota	Shallow Loamy (15e)	Favorable	1,500	Manzanita	25
		Normal	1,000	Black sage	25
		Unfavorable	500	Chamise	10
				California buckwheat	10
				Buckbrush	5
				Red brome	5
				White sage	5
Rock outcrop.					
122, 123 Henneke	Shallow Fine Loamy Serpentine (15e).	Favorable	1,500	Soft chess	35
		Normal	1,000	Wild oat	15
		Unfavorable	500	Buckbrush	5
				Manzanita	5
				Purple needlegrass	5
				Foxtail fescue	5
				Digger pine	5

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
127, 128 Kettleman	Loamy (15g)	Favorable	3,000	Red brome	30
		Normal	2,000	Foxtail fescue	15
		Unfavorable	500	Ripgut brome	10
				Allscale saltbush	5
				Soft chess	5
				Clover	5
				Filaree	5
129*:					
Kettleman	Loamy (15g)	Favorable	3,000	Red brome	30
		Normal	2,000	Foxtail fescue	15
		Unfavorable	500	Ripgut brome	10
				Allscale saltbush	5
				Soft chess	5
				Clover	5
				Filaree	5
Cantua	Loamy (15g)	Favorable	2,800	Red brome	50
		Normal	1,800	Fescue	15
		Unfavorable	700	Filaree	5
				Soft chess	5
				Allscale saltbush	5
				Clover	5
133 Kreyenhagen	Blue Oak-Grass Loamy (15d)	Favorable	3,500	Wild oat	40
		Normal	3,000	Soft chess	30
		Unfavorable	1,500	Pacific fescue	5
				Cheatgrass	5
				Blue oak	5
				Digger pine	5
141, 142, 143 Mercey	Loamy (15g)	Favorable	2,800	Red brome	40
		Normal	2,000	Foxtail fescue	20
		Unfavorable	500	Filaree	10
				Allscale saltbush	5
				Clover	5
145, 146 Millsholm	Blue Oak-Grass Shallow Loamy (15d).	Favorable	3,000	Soft chess	20
		Normal	2,000	Wild oat	15
		Unfavorable	1,000	Filaree	15
				Ripgut brome	10
				Manzanita	10
				Fescue	10
				Blue wildrye	5
				Blue oak	5
152 Parkfield Variant	Clayey (17g)	Favorable	3,200	Red brome	40
		Normal	2,400	Barley	20
		Unfavorable	800	Soft chess	10
				Foxtail fescue	5
				Filaree	5
				Clover	5
				Allscale saltbush	5
156, 157 Reefridge	Clayey (15g)	Favorable	3,200	Red brome	30
		Normal	2,200	Ripgut brome	15
		Unfavorable	800	Wild oat	10
				Barley	10
				Filaree	5
				Soft chess	5
				Fescue	5
				Allscale saltbush	5
				Clover	5

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
161: Sagaser	Blue Oak-Grass Loamy (15d)	Favorable	3,000	Wild oat	30
		Normal	2,500	Blue oak	10
		Unfavorable	1,500	Soft chess	10
				Spanish brome	5
				Digger pine	5
				Goldenbush	5
				Singleleaf ash	5
169*, 170*:					
Vaquero	Clayey (15e)	Favorable	3,300	Wild oat	30
		Normal	2,500	Soft chess	15
		Unfavorable	1,000	Red brome	10
				Filaree	10
				Foxtail fescue	10
				Burclover	5
				Clover	5
Altamont	Clayey (15e)	Favorable	3,300	Wild oat	30
		Normal	2,500	Soft chess	15
		Unfavorable	1,000	Ripgut brome	10
				Filaree	10
				Burclover	5
				Clover	5
				Foxtail fescue	5
				Red brome	5
171*:					
Vaquero	Clayey (15e)	Favorable	3,300	Wild oat	30
		Normal	2,500	Soft chess	15
		Unfavorable	1,000	Red brome	10
				Filaree	10
				Foxtail fescue	10
				Burclover	5
				Clover	5
Altamont	Clayey (15e)	Favorable	3,300	Wild oat	30
		Normal	2,500	Soft chess	15
		Unfavorable	1,000	Ripgut brome	10
				Filaree	10
				Burclover	5
				Clover	5
				Foxtail fescue	5
				Red brome	5
Millsholm	Blue Oak-Grass Shallow Loamy (15d).	Favorable	3,000	Soft chess	20
		Normal	2,000	Wild oat	15
		Unfavorable	1,000	Filaree	15
				Ripgut brome	10
				Manzanita	10
				Fescue	10
				Blue wildrye	5
				Blue oak	5
172, 173: Wadespring	Fine Loamy (15e)	Favorable	3,800	Wild oat	45
		Normal	3,000	Soft chess	20
		Unfavorable	1,500	Red brome	5
				Blue oak	5
				Digger pine	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
101-------------------- Armona	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Severe: excess salt, droughty.
102-------------------- Avenal	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
103-------------------- Boggs	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Severe: excess salt, droughty.
104-------------------- Cajon	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: droughty.
105-------------------- Cantua	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
106-------------------- Cantua	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
107-------------------- Carollo	Severe: excess sodium, excess salt.	Severe: excess salt, percs slowly.	Severe: slope, excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium.
108-------------------- Corona	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
109-------------------- Delgado	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: thin layer.
110-------------------- Delgado	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.	Severe: slope, thin layer.
111-------------------- Delgado	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
112-------------------- Excelsior	Moderate: soil blowing.	Slight----------	Slight----------	Severe: erodes easily.	Moderate: droughty.
113-------------------- Garces	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
114*:					
Gaviota----------------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
Rock outcrop.					
115-------------------- Gepford	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly, excess salt.	Severe: too clayey, percs slowly, excess salt.	Severe: too clayey.	Severe: excess salt, too clayey.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
116 Gepford	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, excess salt, percs slowly.	Severe: too clayey, percs slowly, excess salt.	Severe: too clayey.	Severe: excess salt, too clayey.
117 Goldberg	Severe: flooding, percs slowly, excess sodium.	Severe: excess sodium, percs slowly.	Severe: percs slowly, excess sodium.	Severe: erodes easily.	Severe: excess sodium.
118 Goldberg	Severe: flooding, percs slowly, excess sodium.	Severe: excess sodium, excess salt, percs slowly.	Severe: percs slowly, excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium.
119 Grangeville	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight	Severe: excess salt, excess sodium.
120 Grangeville	Slight	Slight	Slight	Slight	Slight.
121 Grangeville	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight	Severe: excess sodium.
122 Henneke	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: small stones.	Severe: small stones, thin layer.
123 Henneke	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.	Severe: small stones, slope, thin layer.
124 Homeland	Severe: flooding, excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: erodes easily.	Severe: excess salt, excess sodium, droughty.
125 Houser	Severe: flooding, percs slowly, excess sodium.	Severe: excess sodium, excess salt, percs slowly.	Severe: percs slowly, excess sodium, excess salt.	Severe: erodes easily.	Severe: excess sodium, droughty.
126 Houser	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, excess salt, percs slowly.	Severe: too clayey, percs slowly, excess salt.	Severe: too clayey, erodes easily.	Severe: excess salt, droughty.
127 Kettleman	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
128 Kettleman	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
129*: Kettleman	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
129*:					
Cantua	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
130 Kimberlina	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium, droughty.
131 Kimberlina	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: small stones.	Moderate: soil blowing.	Slight.
132*:					
Kimberlina	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium, droughty.
Garces	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
133 Kreyenhagen	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
134 Lakeside	Severe: excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: erodes easily.	Severe: excess salt, excess sodium.
135 Lakeside	Moderate: excess salt.	Moderate: excess salt.	Moderate: excess salt.	Severe: erodes easily.	Moderate: excess salt.
136 Lakeside	Severe: excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: excess salt, excess sodium.	Severe: erodes easily.	Severe: excess salt, excess sodium, too clayey.
137 Lemoore	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium, droughty.
138, 139 Lethent	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
140 Melga	Severe: flooding, cemented pan, excess sodium.	Severe: excess sodium, cemented pan.	Severe: cemented pan, excess sodium.	Severe: erodes easily.	Severe: excess sodium, thin layer.
141 Mercey	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
142 Mercey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
143 Mercey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
144 Milham	Slight	Slight	Slight	Slight	Slight.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
145, 146----------- Millsholm	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
147----------- Nord	Slight-----------	Slight-----------	Slight-----------	Severe: erodes easily.	Slight.
148----------- Nord	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
149*:					
Nord-----------	Slight-----------	Slight-----------	Slight-----------	Severe: erodes easily.	Slight.
Nord-----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
150----------- Panoche	Slight-----------	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
151----------- Panoche	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
152----------- Parkfield Variant	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight-----------	Moderate: small stones, large stones, thin layer.
153----------- Pitco	Severe: percs slowly, too clayey, excess sodium.	Severe: too clayey, excess sodium, excess salt.	Severe: too clayey, percs slowly, excess sodium.	Severe: too clayey, erodes easily.	Severe: excess salt, excess sodium, droughty.
154*:					
Pits.					
Dumps.					
155----------- Rambla	Severe: percs slowly, excess sodium.	Severe: excess sodium, percs slowly.	Severe: percs slowly, excess sodium.	Slight-----------	Severe: excess sodium, droughty.
156----------- Reefridge	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
157----------- Reefridge	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.	Severe: slope, too clayey.
158----------- Remnoy	Severe: flooding, cemented pan, excess sodium.	Severe: excess sodium, excess salt, cemented pan.	Severe: cemented pan, excess sodium.	Severe: erodes easily.	Severe: excess salt, excess sodium, thin layer.
159*:					
Rock outcrop.					
Dystric Lithic Xerochrepts.					
160*:					
Rock outcrop.					
Lithic Torriorthents.					

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
161 Sagaser	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
162 Sandridge	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight	Severe: excess sodium.
163 Tulare	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.
164 Tulare Variant	Severe: percs slowly, too clayey, excess salt.	Severe: too clayey, excess salt, percs slowly.	Severe: too clayey, percs slowly, excess salt.	Severe: too clayey.	Severe: excess salt, droughty, too clayey.
165 Twisselman	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Slight	Severe: too clayey.
166 Twisselman	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight	Severe: excess salt, excess sodium, droughty.
167*. Urban land					
168 Vanguard	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium.
169*, 170*: Vaquero	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too clayey.
Altamont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too clayey.
171*: Vaquero	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too clayey.
Altamont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too clayey.
Millsholm	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, thin layer.
172, 173 Wadespring	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
174 Wasco	Moderate: soil blowing.	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
175------------------- Westcamp	Severe: flooding, percs slowly, excess sodium.	Severe: excess sodium, excess salt, percs slowly.	Severe: percs slowly, excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium.
176------------------- Westhaven	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
177------------------- Westhaven	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
178------------------- Westhaven	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Severe: erodes easily.	Severe: excess sodium.
179------------------- Whitewolf	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: droughty.
180------------------- Youd	Severe: flooding, cemented pan, excess sodium.	Severe: excess sodium, excess salt, cemented pan.	Severe: cemented pan, excess sodium, excess salt.	Severe: erodes easily.	Severe: excess salt, excess sodium, thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
101. Armona	Very poor	Very poor	Very poor	Very poor	Very poor	Fair	Very poor	Poor	Very poor.
102. Avenal	Very poor	Very poor	Poor	Poor	Poor	Very poor	Poor	Very poor	Poor.
103. Boggs	Very poor	Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Very poor.
104. Cajon	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
105, 106. Cantua	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
107. Carollo	Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor.
108. Corona	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
109, 110, 111. Delgado	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
112. Excelsior	Very poor	Very poor	Poor	Poor	Poor	Fair	Very poor	Poor	Poor.
113. Garces	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
114*:									
Gaviota	---	Very poor	Fair	Fair	---	---	---	---	Fair.
Rock outcrop.									
115. Gepford	Very poor	Very poor	Very poor	Very poor	Poor	Fair	Very poor	Poor	Very poor.
116. Gepford	Poor	Poor	Very poor	Very poor	Poor	Good	Poor	Fair	Very poor.
117, 118. Goldberg	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Very poor	Fair	Very poor.
119. Grangeville	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
120. Grangeville	Fair	Good	Good	Good	Fair	Poor	Good	Poor	Good.
121. Grangeville	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Fair	Poor.
122, 123. Henneke	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
124. Homeland	Very poor	Very poor	Very poor	Very poor	Poor	Poor	Very poor	Poor	Very poor.
125, 126. Houser	Very poor	Very poor	Very poor	Very poor	Poor	Good	Very poor	Fair	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
127, 128 Kettleman	Very poor	Very poor	Poor	Fair	---	---	Very poor	---	Poor.
129*:									
Kettleman	Very poor	Very poor	Poor	Fair	---	---	Very poor	---	Poor.
Cantua	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
130, 131 Kimberlina	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
132*:									
Kimberlina	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Garces	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
133 Kreyenhagen	---	Poor	Good	Good	---	---	---	---	Good.
134, 135, 136 Lakeside	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Very poor	Fair	Very poor.
137 Lemoore	Very poor	Very poor	Very poor	Very poor	Fair	Fair	Very poor	Fair	Very poor.
138, 139 Lethent	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
140 Melga	Very poor	Very poor	Fair	Very poor	Very poor	Fair	Very poor	Poor	Poor.
141, 142, 143 Mercey	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
144 Milham	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
145, 146 Millsholm	---	---	Good	Fair	---	---	---	---	Fair.
147 Nord	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	---
148 Nord	Fair	Fair	Poor	Fair	Poor	Very poor	Poor	Very poor	---
149*:									
Nord	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	---
Nord	Fair	Fair	Poor	Fair	Poor	Very poor	Poor	Very poor	---
150 Panoche	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
151 Panoche	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
152 Parkfield Variant	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
153 Pitco	Very poor	Very poor	Very poor	Very poor	Poor	Fair	Very poor	Poor	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
154*:									
Pits.									
Dumps.									
155 Rambla	Very poor	Very poor	Very poor	Very poor	Poor	Good	Very poor	Fair	Very poor.
156, 157 Reefridge	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
158 Remnoy	Poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor.
159*:									
Rock outcrop.									
Dystric Lithic Xerochrepts.									
160*:									
Rock outcrop.									
Lithic Torriorthents.									
161 Sagaser	---	Poor	Good	Good	Very poor	Very poor	---	Very poor	Good.
162 Sandridge	Very poor	Very poor	Fair	Very poor	Very poor	Very poor	Very poor	Very poor	Poor.
163 Tulare	Very poor	Very poor	Very poor	Very poor	Poor	Fair	Very poor	Poor	Very poor.
164 Tulare Variant	Very poor	Very poor	Very poor	Very poor	Poor	Good	Very poor	Fair	Very poor.
165 Twisselman	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
166 Twisselman	Very poor	Very poor	Very poor	Very poor	---	---	Very poor	---	Very poor.
167*. Urban land									
168 Vanguard	Very poor	Very poor	Very poor	Very poor	Poor	Poor	Very poor	Poor	Very poor.
169*:									
Vaquero	Poor	Fair	Good	Poor	---	---	Fair	---	Fair.
Altamont	Poor	Fair	Good	Poor	---	---	Poor	---	Fair.
170*:									
Vaquero	---	---	Good	Poor	---	---	---	---	Fair.
Altamont	---	---	Good	Poor	---	---	---	---	Fair.
171*:									
Vaquero	Poor	Fair	Good	Poor	---	---	Fair	---	Fair.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
171*:									
Altamont	Poor	Fair	Good	Poor	---	---	Poor	---	Fair.
Millsholm	---	---	Good	Fair	---	---	---	---	Fair.
172, 173 Wadespring	---	Poor	Good	Good	Very poor	Very poor	---	Very poor	Good.
174 Wasco	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
175 Westcamp	Very poor	Very poor	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor.
176, 177, 178 Westhaven	Very poor	Very poor	Poor	Poor	---	---	Very poor	---	Poor.
179 Whitewolf	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
180 Youd	Very poor	Very poor	Poor	Very poor	Poor	Fair	Very poor	Poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
101 Armona	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Severe: excess salt, droughty.
102 Avenal	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
103 Boggs	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: excess salt, droughty.
104 Cajon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
105 Cantua	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
106 Cantua	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
107 Carollo	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Severe: excess salt, excess sodium.
108 Corona	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
109 Delgado	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
110 Delgado	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
111 Delgado	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
112 Excelsior	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
113 Garces	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium.
114*:						
Gaviota	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Rock outcrop.						
115 Gepford	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: excess salt, too clayey.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
116 Gepford	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: excess salt, too clayey.
117 Goldberg	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium.
118 Goldberg	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, excess sodium.
119 Grangeville	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: excess salt, excess sodium.
120 Grangeville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Slight.
121 Grangeville	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: excess sodium.
122 Henneke	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: small stones, thin layer.
123 Henneke	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
124 Homeland	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: excess salt, excess sodium, droughty.
125 Houser	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium, droughty.
126 Houser	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, droughty.
127 Kettleman	Moderate: depth to rock, slope.	Moderate: slope, shrink-swell.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: slope, thin layer.
128 Kettleman	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
129*:						
Kettleman	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cantua	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
130 Kimberlina	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium, droughty.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
131 Kimberlina	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
132*:						
Kimberlina	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium, droughty.
Garces	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium.
133 Kreyenhagen	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
134 Lakeside	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Severe: excess salt, excess sodium.
135 Lakeside	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: excess salt.
136 Lakeside	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Severe: excess salt, excess sodium, too clayey.
137 Lemoore	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Slight	Severe: excess salt, excess sodium, droughty.
138, 139 Lethent	Moderate: too clayey.	Severe: shrink-swell.	Slight	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium.
140 Melga	Severe: cemented pan.	Severe: flooding.	Severe: flooding, cemented pan.	Severe: flooding.	Severe: flooding.	Severe: excess sodium, thin layer.
141 Mercey	Moderate: slope, depth to rock.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
142, 143 Mercey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
144 Milham	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
145, 146 Millsholm	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
147 Nord	Slight	Slight	Slight	Slight	Slight	Slight.
148 Nord	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
149*:						
Nord	Slight	Slight	Slight	Slight	Slight	Slight.
Nord	Slight	Slight	Slight	Slight	Slight	Severe: excess sodium.
150 Panoche	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.	Slight.
151 Panoche	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.	Severe: excess sodium.
152 Parkfield Variant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: small stones, large stones, thin layer.
153 Pitco	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, excess sodium, droughty.
154*:						
Pits.						
Dumps.						
155 Rambla	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium, droughty.
156 Reefridge	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
157 Reefridge	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.
158 Remnoy	Severe: cemented pan.	Severe: flooding, cemented pan.	Severe: flooding, cemented pan.	Severe: flooding, cemented pan.	Severe: cemented pan.	Severe: excess salt, excess sodium, thin layer.
159*:						
Rock outcrop.						
Dystric Lithic Xerochrepts.						
160*:						
Rock outcrop.						
Lithic Torriorthents.						
161 Sagaser	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
162 Sandridge	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: excess sodium.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
163---------------- Tulare	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: too clayey.
164---------------- Tulare Variant	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, droughty, too clayey.
165---------------- Twisselman	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
166---------------- Twisselman	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess salt, excess sodium, droughty.
167*. Urban land						
168---------------- Vanguard	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength.	Severe: excess salt, excess sodium.
169*, 170*:						
Vaquero-----------	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.
Altamont----------	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.
171*:						
Vaquero-----------	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.
Altamont----------	Severe: cutbanks cave, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope, too clayey.
Millsholm---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
172, 173----------- Wadespring	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
174---------------- Wasco	Slight----------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
175---------------- Westcamp	Moderate: too clayey, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Severe: excess salt, excess sodium.
176, 177----------- Westhaven	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
178---------------- Westhaven	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Severe: excess sodium.
179---------------- Whitewolf	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
180---------------- Youd	Severe: cemented pan, cutbanks cave.	Severe: flooding, cemented pan.	Severe: flooding, cemented pan.	Severe: flooding, cemented pan.	Severe: cemented pan.	Severe: excess salt, excess sodium, thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
101----------------- Armona	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, excess salt.	Moderate: wetness.	Poor: excess salt.
102----------------- Avenal	Severe: percs slowly.	Moderate: slope.	Slight-----------	Slight-----------	Good.
103----------------- Boggs	Severe: wetness.	Severe: wetness.	Severe: excess salt.	Slight-----------	Poor: thin layer.
104----------------- Cajon	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight-----------	Fair: too sandy, thin layer.
105----------------- Cantua	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, slope, thin layer.
106----------------- Cantua	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
107----------------- Carollo	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim.
108----------------- Corona	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
109----------------- Delgado	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
110, 111------------ Delgado	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
112----------------- Excelsior	Severe: percs slowly.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
113----------------- Garces	Severe: percs slowly.	Slight-----------	Severe: excess salt.	Slight-----------	Good.
114*:					
Gaviota------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
Rock outcrop.					
115----------------- Gepford	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
116: Gepford	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, too sandy.	Severe: flooding.	Poor: too sandy.
117: Goldberg	Severe: percs slowly.	Severe: flooding.	Severe: too clayey, excess sodium, excess salt.	Moderate: flooding.	Poor: too clayey, hard to pack, excess salt.
118: Goldberg	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: too clayey, excess sodium, excess salt.	Moderate: flooding.	Poor: too clayey, hard to pack, excess salt.
119: Grangeville	Severe: wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness, excess sodium.	Severe: seepage, wetness.	Poor: excess sodium.
120: Grangeville	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.
121: Grangeville	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Poor: excess sodium.
122: Henneke	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, small stones.
123: Henneke	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, small stones.
124: Homeland	Severe: wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, excess salt, excess sodium.	Severe: seepage.	Poor: excess salt, excess sodium.
125, 126: Houser	Severe: percs slowly.	Severe: flooding.	Severe: too clayey, excess salt.	Moderate: flooding.	Poor: too clayey, hard to pack, excess salt.
127: Kettleman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
128: Kettleman	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
129*:					
Kettleman	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Cantua	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
130 Kimberlina	Severe: percs slowly.	Slight	Slight	Slight	Good.
131 Kimberlina	Slight	Severe: seepage.	Slight	Slight	Good.
132*:					
Kimberlina	Severe: percs slowly.	Slight	Slight	Slight	Good.
Garces	Severe: percs slowly.	Slight	Severe: excess salt.	Slight	Good.
133 Kreyenhagen	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
134 Lakeside	Severe: percs slowly.	Moderate: wetness.	Severe: excess sodium.	Slight	Poor: too clayey, excess sodium.
135 Lakeside	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
136 Lakeside	Severe: percs slowly.	Moderate: wetness.	Severe: excess sodium.	Slight	Poor: too clayey, excess sodium.
137 Lemoore	Severe: wetness.	Severe: wetness.	Severe: excess sodium, excess salt.	Slight	Poor: excess salt, excess sodium.
138, 139 Lethent	Severe: percs slowly.	Slight	Severe: excess salt.	Slight	Good.
140 Melga	Severe: flooding, cemented pan, percs slowly.	Severe: cemented pan, flooding.	Severe: flooding.	Severe: flooding, cemented pan.	Poor: area reclaim.
141 Mercey	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
142, 143 Mercey	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
144 Milham	Severe: percs slowly.	Slight	Slight	Slight	Good.
145, 146 Millsholm	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
147 Nord	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
148 Nord	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: excess sodium.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
149*:					
Nord	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Nord	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: excess sodium.
150 Panoche	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
151 Panoche	Severe: percs slowly.	Slight	Slight	Slight	Good.
152 Parkfield Variant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
153 Pitco	Severe: percs slowly.	Moderate: wetness.	Severe: too clayey, excess sodium, excess salt.	Slight	Poor: too clayey, hard to pack, excess salt.
154*:					
Pits.					
Dumps.					
155 Rambla	Severe: percs slowly.	Severe: seepage.	Severe: seepage, too clayey, excess sodium.	Severe: seepage.	Poor: too clayey, hard to pack, excess salt.
156 Reefridge	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
157 Reefridge	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
158 Remnoy	Severe: cemented pan, percs slowly.	Severe: cemented pan, flooding.	Severe: cemented pan.	Severe: cemented pan.	Poor: area reclaim.
159*:					
Rock outcrop.					
Dystric Lithic Xerochrepts.					
160*:					
Rock outcrop.					
Lithic Torriorthents.					
161 Sagaser	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
162 Sandridge	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy, excess sodium.	Slight	Poor: too sandy, excess sodium.
163 Tulare	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
164 Tulare Variant	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey, excess salt.	Slight	Poor: too clayey, hard to pack, excess salt.
165 Twisselman	Severe: percs slowly.	Slight	Slight	Slight	Poor: hard to pack.
166 Twisselman	Severe: percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Poor: hard to pack.
167*. Urban land					
168 Vanguard	Severe: wetness.	Severe: flooding, wetness.	Severe: excess sodium, excess salt.	Moderate: flooding, wetness.	Poor: excess sodium.
169*, 170*:					
Vaquero	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Altamont	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
171*:					
Vaquero	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Altamont	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Millsholm	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
172, 173 Wadespring	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
174 Wasco	Slight	Severe: seepage.	Slight	Slight	Good.
175 Westcamp	Severe: percs slowly.	Severe: flooding.	Severe: wetness, excess sodium, excess salt.	Moderate: flooding.	Poor: excess salt, excess sodium.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
176: Westhaven	Severe: percs slowly.	Slight	Slight	Slight	Fair: thin layer.
177: Westhaven	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: thin layer.
178: Westhaven	Severe: percs slowly.	Slight	Slight	Slight	Poor: thin layer.
179: Whitewolf	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy, thin layer.
180: Youd	Severe: cemented pan, percs slowly.	Severe: cemented pan, flooding.	Severe: cemented pan, too sandy, excess sodium.	Severe: cemented pan.	Poor: area reclaim, too sandy, excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
101 Armona	Fair: wetness.	Probable	Improbable: too sandy.	Poor: excess salt.
102 Avenal	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
103 Boggs	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
104 Cajon	Good	Probable	Improbable: too sandy.	Fair: small stones.
105 Cantua	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
106 Cantua	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
107 Carollo	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
108 Corona	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
109 Delgado	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
110 Delgado	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, area reclaim.
111 Delgado	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, area reclaim.
112 Excelsior	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
113 Garces	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
114*: Gaviota	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
115 Gepford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
116-------------------Gepford	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
117-------------------Goldberg	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
118-------------------Goldberg	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
119-------------------Grangeville	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
120-------------------Grangeville	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
121-------------------Grangeville	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
122-------------------Henneke	Poor: area reclaim.	Poor: area reclaim, small stones.	Improbable: excess fines.	Poor: area reclaim, small stones.
123-------------------Henneke	Poor: area reclaim, slope.	Poor: area reclaim, small stones.	Improbable: excess fines.	Poor: area reclaim, small stones.
124-------------------Homeland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
125-------------------Houser	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
126-------------------Houser	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
127-------------------Kettleman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
128-------------------Kettleman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
129*:				
Kettleman------------	Poor: slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Cantua---------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
130-------------------Kimberlina	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
131-------------------Kimberlina	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
132*: Kimberlina	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Garces	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
133 Kreyenhagen	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
134 Lakeside	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, excess salt.
135 Lakeside	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, excess salt.
136 Lakeside	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
137 Lemoore	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
138, 139 Lethent	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
140 Melga	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, excess sodium.
141 Mercey	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
142 Mercey	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
143 Mercey	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
144 Milham	Fair: thin layer, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
145, 146 Millsholm	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
147 Nord	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
148 Nord	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
149*:				
Nord	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Nord	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
150 Panoche	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
151 Panoche	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
152 Parkfield Variant	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
153 Pitco	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
154*:				
Pits.				
Dumps.				
155 Rambla	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
156 Reefridge	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
157 Reefridge	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
158 Remnoy	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, excess salt, excess sodium.
159*:				
Rock outcrop.				
Dystric Lithic Xerochrepts.				
160*:				
Rock outcrop.				
Lithic Torriorthents.				
161 Sagaser	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
162 Sandridge	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
163------------------- Tulare	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
164------------------- Tulare Variant	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
165------------------- Twisselman	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
166------------------- Twisselman	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
167*. Urban land				
168------------------- Vanguard	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
169*, 170*:				
Vaquero--------------	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Altamont-------------	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
171*:				
Vaquero--------------	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Altamont-------------	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Millsholm------------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
172, 173-------------- Wadespring	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
174------------------- Wasco	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
175------------------- Westcamp	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
176, 177-------------- Westhaven	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
178 Westhaven	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
179 Whitewolf	Good	Probable	Improbable: too sandy.	Fair: small stones.
180 Youd	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, excess salt, excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
101 Armona	Moderate: seepage.	Severe: excess salt.	Excess salt	Wetness, droughty.	Erodes easily, wetness.	Excess salt, erodes easily, droughty.
102 Avenal	Slight	Severe: thin layer.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
103 Boggs	Moderate: seepage.	Severe: piping, excess salt.	Deep to water	Droughty, erodes easily, excess salt.	Erodes easily	Excess salt, erodes easily, droughty.
104 Cajon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
105, 106 Cantua	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, slope.	Slope, erodes easily.	Slope, erodes easily, droughty.
107 Carollo	Severe: slope.	Severe: excess sodium, excess salt.	Deep to water	Excess sodium, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, excess salt, excess sodium.
108 Corona	Moderate: seepage.	Severe: thin layer.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily.
109, 110 Delgado	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
111 Delgado	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty.
112 Excelsior	Moderate: seepage.	Severe: piping.	Deep to water	Droughty, percs slowly, excess salt.	Erodes easily, percs slowly.	Excess salt, erodes easily, droughty.
113 Garces	Slight	Severe: piping, excess sodium, excess salt.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
114*:						
Gaviota	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rock outcrop.						
115 Gepford	Slight	Moderate: piping, wetness, excess salt.	Percs slowly, flooding, excess salt.	Wetness, droughty, slow intake.	Wetness	Excess salt, droughty, percs slowly.
116 Gepford	Moderate: seepage.	Severe: piping.	Percs slowly, flooding, cutbanks cave.	Wetness, droughty, slow intake.	Wetness, too sandy.	Excess salt, droughty, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
117 Goldberg	Slight	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly, erodes easily.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
118 Goldberg	Slight	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly, erodes easily.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
119 Grangeville	Severe: seepage.	Severe: piping, excess salt, excess sodium.	Deep to water	Excess sodium, excess salt.	Too sandy	Droughty, excess salt, excess sodium.
120 Grangeville	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Too sandy	Favorable.
121 Grangeville	Severe: seepage.	Severe: piping, excess sodium.	Deep to water	Droughty, excess sodium.	Too sandy	Excess salt, excess sodium.
122, 123 Henneke	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
124 Homeland	Severe: seepage.	Severe: seepage, piping, excess sodium.	Cutbanks cave, excess salt, excess sodium.	Wetness, droughty, excess sodium.	Erodes easily, wetness, too sandy.	Excess salt, excess sodium, erodes easily.
125 Houser	Slight	Severe: excess salt, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
126 Houser	Slight	Severe: excess salt.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Excess salt, erodes easily, droughty.
127, 128 Kettleman	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
129*:						
Kettleman	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Cantua	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, slope.	Slope, erodes easily.	Slope, erodes easily, droughty.
130 Kimberlina	Slight	Severe: piping, excess sodium.	Deep to water	Droughty, excess sodium.	Erodes easily	Excess salt, excess sodium.
131 Kimberlina	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
132*:						
Kimberlina	Slight	Severe: piping, excess sodium.	Deep to water	Droughty, excess sodium.	Erodes easily	Excess salt, excess sodium.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
132*:						
Garces	Slight	Severe: piping, excess sodium, excess salt.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
133 Kreyenhagen	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
134 Lakeside	Slight	Severe: piping, excess sodium.	Deep to water	Erodes easily, excess salt, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
135 Lakeside	Slight	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Excess salt, erodes easily.
136 Lakeside	Slight	Severe: piping, excess sodium.	Deep to water	Erodes easily, excess salt, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
137 Lemoore	Moderate: seepage.	Severe: piping, excess sodium, excess salt.	Deep to water	Droughty, excess sodium, erodes easily.	Erodes easily	Excess salt, excess sodium, erodes easily.
138, 139 Lethent	Slight	Severe: piping, excess sodium, excess salt.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
140 Melga	Severe: cemented pan.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, cemented pan.	Cemented pan, erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
141, 142, 143 Mercey	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
144 Milham	Slight	Moderate: piping.	Deep to water	Percs slowly	Favorable	Favorable.
145, 146 Millsholm	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
147 Nord	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
148 Nord	Slight	Severe: piping, excess sodium.	Deep to water	Droughty, erodes easily, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
149*:						
Nord	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Nord	Slight	Severe: piping, excess sodium.	Deep to water	Droughty, erodes easily, excess sodium.	Erodes easily	Excess salt, excess sodium, erodes easily.
150 Panoche	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
151---------------- Panoche	Slight----------	Severe: piping, excess sodium.	Deep to water	Erodes easily, excess sodium.	Erodes easily	Excess salt, excess sodium.
152---------------- Parkfield Variant	Moderate: depth to rock, slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Percs slowly, depth to rock, slope.	Large stones, depth to rock, percs slowly.	Large stones, depth to rock, percs slowly.
153---------------- Pitco	Slight----------	Severe: excess sodium, excess salt.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
154*: Pits.						
Dumps.						
155---------------- Rambla	Moderate: seepage.	Severe: hard to pack, excess sodium, excess salt.	Deep to water	Droughty, fast intake, soil blowing.	Erodes easily, soil blowing, percs slowly.	Excess salt, excess sodium, erodes easily.
156, 157----------- Reefridge	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
158---------------- Remnoy	Severe: cemented pan.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Cemented pan, erodes easily.	Excess salt, excess sodium, erodes easily.
159*: Rock outcrop.						
Dystric Lithic Xerochrepts.						
160*: Rock outcrop.						
Lithic Torriorthents.						
161---------------- Sagaser	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope-----------	Slope, erodes easily.	Slope, erodes easily.
162---------------- Sandridge	Severe: seepage.	Severe: seepage, piping, excess sodium.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Excess sodium, droughty.
163---------------- Tulare	Slight----------	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly---	Excess salt, percs slowly.
164---------------- Tulare Variant	Moderate: seepage.	Severe: hard to pack, excess salt.	Deep to water	Droughty, slow intake, percs slowly.	Percs slowly---	Excess salt, droughty, percs slowly.
165---------------- Twisselman	Slight----------	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
166----------------- Twisselman	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Droughty, slow intake, percs slowly.	Percs slowly---	Excess salt, excess sodium.
167*. Urban land						
168----------------- Vanguard	Moderate: seepage.	Severe: excess sodium, excess salt.	Excess salt, excess sodium.	Wetness, droughty, excess sodium.	Erodes easily, wetness.	Excess salt, excess sodium, erodes easily.
169*, 170*: Vaquero-----------	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Altamont---------	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
171*: Vaquero-----------	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Altamont---------	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Millsholm--------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
172, 173---------- Wadespring	Severe: slope.	Moderate: thin layer, piping, large stones.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
174----------------- Wasco	Severe: seepage.	Severe: piping.	Deep to water	Droughty--------	Favorable------	Droughty.
175----------------- Westcamp	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
176----------------- Westhaven	Slight---------	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
177----------------- Westhaven	Moderate: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
178----------------- Westhaven	Slight---------	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
179----------------- Whitewolf	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty--------	Too sandy------	Droughty.
180----------------- Youd	Severe: cemented pan.	Severe: thin layer, piping, excess sodium.	Deep to water	Droughty, cemented pan, excess sodium.	Cemented pan, erodes easily, too sandy.	Excess salt, excess sodium, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
101--------------- Armona	0-14	Loam--------------	ML	A-4	0	90-100	90-100	85-95	50-70	25-35	NP-10
	14-41	Stratified sandy loam to clay loam.	CL	A-6, A-7	0	90-100	90-100	85-100	60-85	30-45	10-20
	41-60	Sand--------------	SP-SM, SM	A-1, A-3, A-2	0	90-100	80-100	45-65	5-15	---	NP
102--------------- Avenal	0-8	Loam--------------	ML, CL-ML	A-4	0	100	100	85-95	60-85	25-35	5-10
	8-36	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-85	30-40	10-20
	36-61	Clay loam, loam, silt loam.	CL-ML, CL	A-4, A-6	0	100	100	85-95	60-85	25-35	5-15
103--------------- Boggs	0-15	Sandy loam--------	SM	A-2, A-4	0	90-100	90-100	60-70	30-40	25-30	NP-5
	15-38	Sandy loam, fine sandy loam, coarse sandy loam.	SM	A-2, A-4	0	90-100	90-100	50-85	25-50	25-30	NP-5
	38-46	Stratified sand to clay loam.	SM	A-2, A-4	0	90-100	90-100	50-85	25-50	25-30	NP-5
	46-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	85-100	60-85	30-50	25-30	NP-5
104--------------- Cajon	0-11	Sandy loam--------	SM	A-2	0	90-100	85-100	50-70	25-35	20-30	NP-5
	11-60	Loamy sand--------	SM	A-2, A-1	0	90-100	85-100	45-70	10-25	---	NP
	60-70	Stratified sand to loamy fine sand.	SM, SP-SM	A-1, A-2, A-3	0	90-100	85-100	40-70	5-25	---	NP
105, 106---------- Cantua	0-6	Coarse sandy loam	SM	A-2	0	100	95-100	50-60	25-35	20-25	NP-5
	6-55	Sandy loam, coarse sandy loam.	SM	A-2, A-4	0	100	95-100	50-70	25-40	20-25	NP-5
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
107--------------- Carollo	0-2	Clay loam---------	CL	A-6, A-7	0	100	100	90-100	70-90	30-45	10-20
	2-19	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-60	20-35
	19-32	Clay loam---------	CL	A-6, A-7	0	100	100	90-100	65-80	30-45	10-20
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
108--------------- Corona	0-25	Silt loam---------	ML	A-4	0	100	100	85-95	60-80	20-40	NP-10
	25-42	Silty clay loam	CL, ML	A-6, A-7	0	100	100	90-100	80-85	35-45	10-20
	42-55	Loam--------------	ML	A-4	0	100	100	85-95	50-75	25-35	NP-10
	55-64	Sandy loam, loam	SM, ML	A-4	0	100	100	70-95	35-70	20-35	NP-10
109, 110---------- Delgado	0-2	Sandy loam--------	SM	A-4	0-10	80-100	75-100	45-70	35-50	20-30	NP-5
	2-10	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0-10	80-100	75-100	45-70	25-50	20-30	NP-10
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
111--------------- Delgado	0-2	Gravelly sandy loam.	SM, GM	A-1, A-2	0-10	60-80	50-75	30-50	20-35	20-30	NP-5
	2-10	Gravelly sandy loam, gravelly fine sandy loam.	SM, GM, SM-SC, GM-GC	A-1, A-2	0-10	60-80	50-75	30-50	20-35	20-30	NP-10
	10	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
112 Excelsior	0-8	Sandy loam	SM	A-2, A-4	0	100	100	60-70	30-45	25-30	NP-5
	8-26	Stratified sandy loam to loamy sand.	SM	A-2, A-4	0	100	100	50-70	30-50	25-30	NP-5
	26-60	Stratified sandy loam to silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	60-90	35-70	20-30	NP-10
113 Garces	0-9	Loam	CL-ML	A-4	0	100	100	85-100	50-85	20-30	5-10
	9-17	Clay loam, silty clay loam.	CL	A-6	0	100	100	85-100	65-85	30-40	10-20
	17-22	Sandy clay loam, loam.	SC, CL	A-6	0	100	100	80-95	35-60	30-40	10-20
	22-60	Stratified sandy loam to clay loam.	SM, ML	A-4	0	100	100	60-95	35-60	20-35	NP-10
114*:											
Gaviota	0-12	Loam	ML	A-4	0-5	80-100	75-95	60-90	50-65	20-35	NP-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
115 Gepford	0-25	Clay	CL, CH	A-7	0	100	100	90-100	75-95	45-70	20-40
	25-38	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	40-70	20-40
	38-60	Stratified loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-20
116 Gepford	0-25	Clay	CL, CH	A-7	0	100	100	90-100	75-95	45-70	20-40
	25-42	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	40-70	20-40
	42-60	Fine sand, loamy fine sand.	SM	A-2, A-4	0	100	100	65-90	20-40	---	NP
117 Goldberg	0-1	Loam	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	1-6	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	6-32	Clay, clay loam	CH, CL	A-7	0	100	100	90-100	75-95	45-55	20-30
	32-38	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	38-60	Stratified loamy sand to clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	70-80	25-40	5-15
118 Goldberg	0-4	Loam	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	4-16	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	16-32	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	45-55	20-30
	32-44	Clay	CH	A-7	0	100	100	90-100	75-95	50-55	25-30
	44-60	Stratified loamy sand to clay loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	70-80	25-40	5-15
119 Grangeville	0-6	Sandy loam	SM	A-4	0	100	95-100	60-85	35-50	20-30	NP-5
	6-21	Sandy loam, fine sandy loam, loam.	SM, ML	A-4	0	100	95-100	60-95	35-60	20-35	NP-10
	21-63	Stratified loamy sand to silt loam.	SM	A-2, A-4	0	100	95-100	60-95	25-50	15-25	NP-5
120, 121 Grangeville	0-10	Fine sandy loam	SM	A-4	0	100	95-100	60-85	35-50	20-30	NP-5
	10-60	Sandy loam, fine sandy loam, loam.	SM, ML	A-4	0	100	95-100	60-95	35-60	20-35	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
122, 123---------- Henneke	0-3	Very gravelly clay loam.	GC	A-2	5-30	50-60	30-40	25-35	25-35	40-60	15-30
	3-18	Very gravelly clay loam, very gravelly clay.	GC	A-2, A-7	5-30	50-60	30-50	25-50	20-40	40-60	15-30
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
124-------------- Homeland	0-8	Fine sandy loam	SM	A-2, A-4	0	100	100	60-80	30-50	20-30	NP-5
	8-15	Stratified very fine sandy loam to sandy loam.	SM, ML	A-4	0	100	100	60-90	35-60	25-30	NP-5
	15-60	Stratified very fine sandy loam to loamy sand.	SM	A-2	0	100	100	50-75	15-30	---	NP
125-------------- Houser	0-4	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	20-30	NP-5
	4-60	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	40-65	20-35
126-------------- Houser	0-20	Clay-------------	CL, CH	A-7	0	100	100	90-100	75-95	40-65	20-35
	20-60	Stratified silt loam to clay.	CL, CH	A-7	0	100	100	90-100	75-95	40-65	20-35
127, 128--------- Kettleman	0-13	Loam-------------	CL-ML, ML	A-4	0	85-100	80-100	70-90	50-70	25-35	5-10
	13-39	Loam, clay loam	CL-ML, CL	A-4, A-6	0	85-100	80-100	75-95	50-80	25-40	5-15
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
129*:											
Kettleman--------	0-13	Loam-------------	CL-ML, ML	A-4	0	85-100	80-100	70-90	50-70	25-35	5-10
	13-39	Loam, clay loam	CL-ML, CL	A-4, A-6	0	85-100	80-100	75-95	50-80	25-40	5-15
	39	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cantua-----------	0-6	Coarse sandy loam	SM	A-2	0	100	95-100	50-60	25-35	20-25	NP-5
	6-55	Sandy loam, coarse sandy loam.	SM	A-2, A-4	0	100	95-100	50-70	25-40	20-25	NP-5
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
130-------------- Kimberlina	0-8	Fine sandy loam	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	20-30	NP-5
	8-60	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	20-30	NP-5
131-------------- Kimberlina	0-8	Fine sandy loam	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	25-30	NP-5
	8-41	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	25-30	NP-5
	41-60	Loamy fine sand, loamy sand.	SM	A-1, A-2	0	100	85-100	40-60	15-35	---	NP
132*:											
Kimberlina-------	0-8	Fine sandy loam	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	20-30	NP-5
	8-60	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	80-100	75-100	40-70	25-50	20-30	NP-5
Garces-----------	0-9	Loam-------------	CL-ML	A-4	0	100	100	85-100	50-85	20-30	5-10
	9-17	Clay loam, silty clay loam.	CL	A-6	0	100	100	85-100	65-85	30-40	10-20
	17-22	Sandy clay loam, loam.	SC, CL	A-6	0	100	100	80-95	35-60	30-40	10-20
	22-60	Stratified sandy loam to clay loam.	SM, ML	A-4	0	100	100	60-95	35-60	20-35	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
133-------------- Kreyenhagen	0-2	Loam-------------	CL-ML, ML	A-4	0	100	100	85-95	65-85	25-35	5-10
	2-45	Clay loam--------	ML, CL	A-6, A-7	0	100	100	90-100	85-95	30-45	10-15
	45	Weathered bedrock	---	---	---	---	---	---	---	---	---
134-------------- Lakeside	0-17	Loam-------------	ML	A-4	0	100	90-100	85-95	50-75	25-35	NP-10
	17-60	Stratified sandy loam to clay.	CL-ML, CL	A-4, A-6, A-7	0	80-100	75-100	60-95	50-80	25-45	5-20
135-------------- Lakeside	0-17	Clay loam--------	CL	A-6, A-7	0	100	90-100	90-100	70-80	30-45	10-20
	17-60	Stratified sandy loam to clay.	CL-ML, CL	A-4, A-6, A-7	0	80-100	75-100	75-100	60-80	25-45	5-20
136-------------- Lakeside	0-12	Clay-------------	CL, CH	A-7	0	100	90-100	80-100	70-95	45-55	20-30
	12-60	Stratified sandy loam to clay.	CL-ML, CL	A-4, A-6, A-7	0	80-100	75-100	60-95	50-80	25-45	5-20
137-------------- Lemoore	0-7	Sandy loam-------	SM	A-2, A-4	0	100	100	60-70	30-45	25-30	NP-5
	7-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	100	100	60-85	30-50	25-30	NP-5
138-------------- Lethent	0-8	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	20-30	NP-5
	8-21	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	70-95	40-60	15-30
	21-60	Sandy loam, loam, clay loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	100	100	60-95	35-75	25-40	5-15
139-------------- Lethent	0-6	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-85	30-45	10-20
	6-24	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	70-95	40-60	15-30
	24-31	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	31-60	Sandy loam, loam, clay loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	100	100	60-95	35-75	25-40	5-15
140-------------- Melga	0-4	Silt loam--------	CL-ML, ML	A-4	0	100	100	85-100	60-90	25-35	5-10
	4-18	Silty clay loam, clay loam.	ML	A-7	0	100	100	90-100	85-95	40-50	10-20
	18-26	Clay loam--------	ML	A-6, A-7	0	100	95-100	80-90	50-80	35-45	10-15
	26-60	Stratified fine sandy loam to silty clay loam.	CL-ML, ML	A-4	0	100	100	80-100	60-85	25-35	5-10
141, 142, 143---- Mercey	0-3	Loam-------------	ML, CL-ML	A-4	0	100	95-100	85-95	80-90	25-35	5-10
	3-25	Loam, clay loam	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-90	25-40	5-15
	25	Weathered bedrock	---	---	---	---	---	---	---	---	---
144-------------- Milham	0-14	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	50-75	25-40	20-30	NP-5
	14-32	Loam, sandy clay loam.	CL, SC	A-6	0	95-100	90-100	75-85	40-65	30-40	10-15
	32-60	Silty clay loam	CL, ML	A-6	0	100	100	95-100	85-95	35-40	10-15
145, 146--------- Millsholm	0-4	Clay loam--------	CL	A-6	0	80-100	75-100	70-95	60-85	30-40	10-20
	4-17	Clay loam--------	CL	A-4	0	80-100	75-100	70-95	60-85	30-40	10-20
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
147, 148--------- Nord	0-18	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	35-55	20-30	NP-5
	18-72	Stratified sandy loam to loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	60-95	35-70	20-30	NP-10
149*:											
Nord------------	0-18	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	35-55	20-30	NP-5
	18-72	Stratified sandy loam to loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	60-95	35-70	20-30	NP-10

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
149*:											
Nord------------	0-18	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	35-55	20-30	NP-5
	18-72	Stratified sandy loam to loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	60-95	35-70	20-30	NP-10
150-------------- Panoche	0-7	Loam-------------	CL-ML, ML	A-4	0	95-100	95-100	80-95	50-70	25-35	5-10
	7-60	Loam, clay loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-100	50-85	25-40	5-20
151-------------- Panoche	0-7	Clay loam--------	CL	A-6	0	95-100	95-100	85-100	60-85	25-40	10-20
	7-60	Clay loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	95-100	95-100	80-100	50-85	25-40	5-20
152-------------- Parkfield Variant	0-4	Gravelly clay loam.	CL, SC, GC	A-6	5-20	65-80	60-75	55-70	40-65	30-40	10-20
	4-35	Clay loam, clay	CL, CH	A-7	5-15	95-100	90-100	80-95	70-95	40-60	20-35
	35	Weathered bedrock	---	---	---	---	---	---	---	---	---
153-------------- Pitco	0-23	Clay-------------	CL, CH	A-7	0	100	100	90-100	75-95	40-65	20-35
	23-60	Clay loam, clay	CL, CH	A-7	0	100	100	85-100	70-95	40-65	20-35
154*:											
Pits.											
Dumps.											
155-------------- Rambla	0-15	Loamy sand-------	SM	A-2	0	100	100	50-75	15-30	---	NP
	15-19	Stratified loamy sand to sandy loam.	SM	A-2	0	100	100	60-70	15-35	---	NP
	19-45	Clay-------------	MH, CH	A-7	0	100	100	90-100	75-95	50-60	20-30
	45-60	Loamy sand-------	SM	A-2	0	100	100	50-75	15-30	---	NP
156, 157--------- Reefridge	0-14	Clay-------------	CL, CH	A-7	0	100	100	90-100	75-95	45-70	20-40
	14-48	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	85-100	70-95	45-70	20-40
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
158-------------- Remnoy	0-5	Very fine sandy loam.	ML	A-4	0	100	100	85-95	50-65	25-30	NP-5
	5-15	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	15-29	Indurated--------	---	---	---	---	---	---	---	---	---
	29-70	Stratified sandy loam to silt loam.	SM, ML	A-4	0	100	100	60-100	35-70	25-35	NP-10
159*:											
Rock outcrop.											
Dystric Lithic Xerochrepts.											
160*:											
Rock outcrop.											
Lithic Torriorthents.											
161-------------- Sagaser	0-6	Loam-------------	CL-ML, ML	A-4	0	95-100	95-100	80-90	50-75	25-35	5-10
	6-34	Clay loam--------	CL	A-6	0	95-100	90-95	75-85	55-75	30-40	10-15
	34-42	Shaly clay loam	CL, SC	A-6	0-5	75-90	65-80	55-75	40-55	30-40	10-15
	42	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
162--------------- Sandridge	0-24	Loamy fine sand	SM	A-2, A-4	0	100	100	50-90	15-40	---	NP
	24-60	Loamy fine sand, loamy sand, sand.	SM	A-2, A-4	0	100	100	50-90	10-40	---	NP
163--------------- Tulare	0-16	Clay--------------	CL, CH	A-7	0	100	100	90-100	75-90	40-70	20-40
	16-60	Clay, silty clay	CL, CH	A-7	0	100	100	90-100	75-95	40-70	20-40
164--------------- Tulare Variant	0-10	Clay--------------	CH	A-7	0	100	100	95-100	95-100	55-75	30-50
	10-56	Clay--------------	CH	A-7	0	100	100	95-100	95-100	55-75	30-50
	56-60	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	25-30	NP-5
165, 166---------- Twisselman	0-9	Silty clay--------	MH, CH	A-7	0	100	100	90-100	75-95	50-65	20-35
	9-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	90-100	70-95	40-65	15-35
167*. Urban land											
168--------------- Vanguard	0-16	Sandy loam--------	SM	A-4	0	100	100	60-80	35-50	20-30	NP-5
	16-60	Stratified fine sandy loam to sandy clay loam.	CL	A-6, A-7	0	100	100	75-100	50-85	30-45	10-20
169*, 170*: Vaquero----------	0-17	Clay--------------	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
	17-36	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Altamont---------	0-31	Clay--------------	CH, CL	A-7	0	100	95-100	95-100	75-95	40-70	20-40
	31-55	Clay, silty clay, clay loam.	CH, CL	A-7	0	100	95-100	95-100	75-95	40-70	20-40
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
171*: Vaquero----------	0-17	Clay--------------	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
	17-36	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Altamont---------	0-31	Clay--------------	CH, CL	A-7	0	100	95-100	95-100	75-95	40-70	20-40
	31-55	Clay, silty clay, clay loam.	CH, CL	A-7	0	100	95-100	95-100	75-95	40-70	20-40
	55	Weathered bedrock	---	---	---	---	---	---	---	---	---
Millsholm--------	0-4	Clay loam---------	CL	A-6	0	80-100	75-100	70-95	60-85	30-40	10-20
	4-17	Clay loam---------	CL	A-4	0	80-100	75-100	70-95	60-85	30-40	10-20
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
172, 173---------- Wadespring	0-1	Stony loam--------	ML, CL-ML	A-4	10-15	90-95	90-95	75-90	50-70	25-35	5-10
	1-18	Clay loam---------	CL	A-6	5-10	90-95	90-95	80-90	60-80	30-40	10-20
	18-31	Cobbly clay loam	CL	A-6	15-35	80-95	80-90	70-85	55-70	30-40	10-20
	31	Weathered bedrock	---	---	---	---	---	---	---	---	---
174--------------- Wasco	0-20	Sandy loam--------	SM	A-2, A-4	0	80-100	75-100	45-65	25-40	20-25	NP-5
	20-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	80-100	75-100	45-80	25-50	20-25	NP-5
175--------------- Westcamp	0-10	Loam--------------	CL-ML, ML	A-4	0	100	100	85-100	60-90	25-35	5-10
	10-37	Stratified fine sandy loam to silty clay loam.	CL, ML	A-6, A-7	0	100	100	90-100	85-95	30-45	10-15
	37-72	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-60	15-35

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
176, 177: Westhaven	0-7	Loam	CL-ML, ML	A-4	0	100	100	85-95	60-75	25-35	5-10
	7-45	Stratified fine sandy loam to clay.	CL	A-6	0	100	100	95-100	85-95	30-40	10-15
	45-72	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-55	15-30
	72-84	Stratified loamy sand to sandy loam.	SM	A-2	0	100	100	55-65	15-35	---	NP
178: Westhaven	0-10	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-80	30-45	10-20
	10-40	Stratified fine sandy loam to clay.	CL	A-6	0	100	100	90-100	85-95	30-40	10-15
	40-60	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-55	15-30
179: Whitewolf	0-10	Coarse sandy loam	SM	A-2	0	80-100	75-100	50-65	20-35	---	NP
	10-60	Sand	SP-SM, SM	A-1, A-2, A-3	0	80-100	75-100	40-70	5-15	---	NP
180: Youd	0-10	Fine sandy loam	SM	A-4	0	100	100	70-85	35-50	20-30	NP-5
	10-26	Cemented	---	---	---	---	---	---	---	---	---
	26-60	Stratified sand to silt loam.	SM, SM-SC	A-4	0	100	100	60-90	35-50	20-30	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
101 Armona	0-14	10-27	0.2-0.6	0.02-0.12	7.4-9.0	>8	Low	0.43	5	7	1-2
	14-41	20-35	0.2-0.6	0.02-0.14	>7.3	>8	Moderate	0.43			
	41-60	0-5	6.0-20	0.02-0.04	>7.3	>8	Low	0.20			
102 Avenal	0-8	20-27	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low	0.43	5	6	<.5
	8-36	27-35	0.2-0.6	0.17-0.19	7.4-8.4	<2	Moderate	0.32			
	36-61	20-30	0.2-0.6	0.14-0.18	7.9-8.4	<2	Low	0.32			
103 Boggs	0-15	5-18	0.6-2.0	0.01-0.06	>7.3	>16	Low	0.37	5	5	<1
	15-38	5-18	0.6-2.0	0.01-0.06	>7.8	>16	Low	0.37			
	38-46	5-18	0.6-2.0	0.01-0.06	>7.8	>16	Low	0.37			
	46-60	5-18	0.6-2.0	0.01-0.06	>7.8	>16	Low	0.37			
104 Cajon	0-11	8-18	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low	0.28	5	3	<1
	11-60	0-8	6.0-20	0.06-0.09	7.4-8.4	<2	Low	0.15			
	60-70	0-5	6.0-20	0.06-0.10	7.4-8.4	<2	Low	0.15			
105, 106 Cantua	0-6	6-15	2.0-6.0	0.09-0.12	6.1-7.3	<2	Low	0.43	3	5	<.5
	6-55	6-15	2.0-6.0	0.09-0.12	6.6-7.8	<2	Low	0.43			
	55	---	---	---	---	---	---------	----			
107 Carollo	0-2	27-32	<0.06	0.02-0.15	6.6-7.8	>4	Moderate	0.37	1	6	<1
	2-19	40-60	<0.06	0.02-0.08	6.6-8.4	>16	High	0.32			
	19-32	30-40	<0.06	0.02-0.08	6.6-8.4	>16	Moderate	0.32			
	32	---	---	---	---	---	---------	----			
108 Corona	0-25	10-25	0.6-2.0	0.14-0.16	7.4-8.4	<4	Low	0.43	5	7	1-2
	25-42	27-35	0.2-0.6	0.17-0.19	7.4-8.4	<4	Moderate	0.37			
	42-55	10-25	0.06-0.2	0.14-0.16	7.4-8.4	<4	Low	0.43			
	55-64	7-25	0.6-2.0	0.10-0.16	6.6-7.8	<4	Low	0.37			
109, 110 Delgado	0-2	8-20	2.0-6.0	0.09-0.12	6.6-8.4	<2	Low	0.37	1	5	<.5
	2-10	8-20	2.0-6.0	0.09-0.13	7.9-8.4	<2	Low	0.37			
	10	---	---	---	---	---	---------	----			
111 Delgado	0-2	8-20	2.0-6.0	0.06-0.11	6.6-8.4	<2	Low	0.24	1	8	<.5
	2-10	8-20	2.0-6.0	0.06-0.11	7.9-8.4	<2	Low	0.24			
	10	---	---	---	---	---	---------	----			
112 Excelsior	0-8	5-18	0.6-2.0	0.08-0.12	7.9-9.0	<8	Low	0.37	5	7	<1
	8-26	5-18	0.6-2.0	0.08-0.12	>8.4	<8	Low	0.24			
	26-60	8-18	0.06-0.2	0.05-0.15	>8.4	2-16	Low	0.43			
113 Garces	0-9	10-18	0.2-0.6	0.11-0.16	6.6-9.0	2-8	Low	0.49	5	6	<.5
	9-17	27-35	<0.06	0.07-0.13	>7.9	>8	Moderate	0.43			
	17-22	20-35	<0.06	0.07-0.13	>7.9	>8	Moderate	0.43			
	22-60	10-27	0.2-0.6	0.05-0.14	>87.9	>4	Low	0.43			
114*:											
Gaviota	0-12	10-18	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low	0.43	1	8	<1
	12	---	---	---	---	---	---------	----			
Rock outcrop.											
115 Gepford	0-25	50-60	<0.06	0.08-0.13	7.4-8.4	4-16	High	0.28	5	8	1-2
	25-38	50-60	<0.06	0.08-0.13	7.4-8.4	4-16	High	0.28			
	38-60	25-40	0.2-0.6	0.08-0.16	7.4-8.4	4-16	Moderate	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
116-------------- Gepford	0-25	50-60	<0.06	0.08-0.14	7.4-8.4	4-16	High------	0.28	5	8	1-2
	25-42	50-60	<0.06	0.08-0.15	7.4-8.4	4-16	High------	0.28			
	42-60	1-5	2.0-20	0.03-0.10	7.4-8.4	4-16	Low-------	0.15			
117-------------- Goldberg	0-1	12-27	0.6-2.0	0.13-0.18	6.6-8.4	<4	Low-------	0.37	5	7	1-5
	1-6	35-40	0.06-0.2	0.15-0.21	>7.8	<4	Moderate	0.37			
	6-32	35-50	<0.06	0.06-0.14	>8.4	>4	High------	0.32			
	32-38	27-40	0.06-0.2	0.07-0.19	>7.8	>4	Moderate	0.32			
	38-60	15-30	0.06-0.2	0.07-0.19	>7.8	>4	Low-------	0.32			
118-------------- Goldberg	0-4	12-27	0.6-2.0	0.08-0.17	7.4-8.4	>2	Low-------	0.37	5	7	1-5
	4-16	35-40	0.06-0.2	0.07-0.19	7.4-9.0	>2	Moderate	0.37			
	16-32	35-50	<0.06	0.06-0.18	>7.8	>4	High------	0.32			
	32-44	40-50	<0.06	0.06-0.14	>7.8	>2	High------	0.32			
	44-60	15-30	0.06-0.2	0.04-0.16	>7.8	>2	Low-------	0.32			
119-------------- Grangeville	0-6	8-18	2.0-6.0	0.06-0.14	7.4-9.0	4-16	Low-------	0.32	5	7	1-6
	6-21	8-18	0.6-2.0	0.06-0.14	7.4-9.0	4-16	Low-------	0.32			
	21-63	8-18	0.6-2.0	0.06-0.10	7.4-9.0	4-16	Low-------	0.32			
120-------------- Grangeville	0-10	8-18	2.0-6.0	0.12-0.14	6.1-8.4	<2	Low-------	0.32	5	7	1-6
	10-60	8-18	2.0-6.0	0.12-0.15	6.6-8.4	<2	Low-------	0.32			
121-------------- Grangeville	0-10	8-18	2.0-6.0	0.10-0.13	7.4-9.0	4-8	Low-------	0.32	5	7	1-6
	10-60	8-18	0.6-2.0	0.10-0.13	7.4-9.0	4-8	Low-------	0.32			
122, 123--------- Henneke	0-3	27-45	0.2-0.6	0.06-0.09	5.6-7.3	<2	Moderate	0.15	1	8	2-7
	3-18	35-55	0.2-0.6	0.06-0.09	6.6-8.4	<2	Moderate	0.15			
	18	---	---	---	---	---	---------	----			
124-------------- Homeland	0-8	5-15	0.6-2.0	0.02-0.12	7.9-8.4	>4	Low-------	0.37	5	5	<1
	8-15	8-15	0.6-2.0	0.04-0.14	7.9-8.4	>4	Low-------	0.43			
	15-60	5-12	2.0-6.0	0.02-0.07	7.9-8.4	>4	Low-------	0.24			
125-------------- Houser	0-4	5-20	2.0-6.0	0.12-0.15	7.9-8.4	<4	Low-------	0.37	5	5	<1
	4-60	40-60	<0.06	0.01-0.14	>8.4	>8	High------	0.37			
126-------------- Houser	0-20	40-60	<0.06	0.02-0.14	7.9-9.0	>2	High------	0.37	5	8	<1
	20-60	40-60	<0.06	0.02-0.11	7.9-9.0	>8	High------	0.43			
127, 128--------- Kettleman	0-13	18-27	0.6-2.0	0.14-0.16	6.6-8.4	<2	Low-------	0.37	2	6	<.5
	13-39	18-30	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	0.37			
	39	---	---	---	---	---	---------	----			
129*:											
Kettleman--------	0-13	18-27	0.6-2.0	0.14-0.16	6.6-8.4	<2	Low-------	0.37	2	6	<.5
	13-39	18-30	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	0.37			
	39	---	---	---	---	---	---------	----			
Cantua-----------	0-6	6-15	2.0-6.0	0.09-0.12	6.1-7.3	<2	Low-------	0.43	3	5	<.5
	6-55	6-15	2.0-6.0	0.09-0.12	6.6-7.8	<2	Low-------	0.43			
	55	---	---	---	---	---	---------	----			
130-------------- Kimberlina	0-8	6-18	2.0-6.0	0.02-0.08	7.9-8.4	4-8	Low-------	0.37	5	5	<1
	8-60	10-18	0.2-0.6	0.02-0.08	7.9-8.4	4-8	Low-------	0.37			
131-------------- Kimberlina	0-8	6-18	2.0-6.0	0.10-0.13	6.6-8.4	<2	Low-------	0.32	5	5	<1
	8-41	6-18	2.0-6.0	0.10-0.13	7.9-8.4	<4	Low-------	0.32			
	41-60	5-10	2.0-6.0	0.07-0.10	6.6-8.4	<4	Low-------	0.28			
132*:											
Kimberlina------	0-8	6-18	2.0-6.0	0.02-0.08	7.9-8.4	4-8	Low-------	0.37	5	5	<1
	8-60	10-18	0.2-0.6	0.02-0.08	7.9-8.4	4-8	Low-------	0.37			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
132*:											
Garces	0-9	10-18	0.2-0.6	0.11-0.16	7.4-9.0	2-8	Low	0.49	5	6	<.5
	9-17	27-35	<0.06	0.07-0.13	>8.4	>8	Moderate	0.43			
	17-22	20-35	<0.06	0.07-0.13	>8.4	>8	Moderate	0.43			
	22-60	10-27	0.2-0.6	0.05-0.14	>8.4	>4	Low	0.43			
133 Kreyenhagen	0-2	20-27	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.43	3	8	.5-1
	2-45	30-35	0.2-0.6	0.17-0.18	6.6-8.4	<2	Moderate	0.37			
	45	---	---	---	---	---	---	---			
134 Lakeside	0-17	10-27	0.2-0.6	0.08-0.14	6.6-8.4	4-16	Low	0.37	5	6	1-2
	17-60	20-35	0.2-0.6	0.08-0.15	7.4-9.0	4-16	Moderate	0.37			
135 Lakeside	0-17	27-35	0.2-0.6	0.14-0.16	6.6-8.4	4-8	Moderate	0.37	5	7	1-2
	17-60	20-35	0.2-0.6	0.12-0.15	7.4-9.0	4-8	Moderate	0.37			
136 Lakeside	0-12	40-50	0.06-0.2	0.08-0.14	6.6-8.4	4-16	High	0.37	5	8	1-2
	12-60	20-35	0.2-0.6	0.08-0.15	7.4-9.0	4-16	Moderate	0.37			
137 Lemoore	0-7	5-18	0.6-2.0	0.02-0.11	6.6-9.0	>4	Low	0.43	5	5	<1
	7-60	5-18	0.6-2.0	0.02-0.10	>8.4	>4	Low	0.43			
138 Lethent	0-8	8-20	0.2-0.6	0.10-0.14	>7.8	4-8	Low	0.37	5	5	<.5
	8-21	35-55	<0.06	0.06-0.10	7.9-9.0	4-16	High	0.49			
	21-60	10-30	0.06-0.2	0.02-0.10	7.9-9.0	>8	Low	0.49			
139 Lethent	0-6	27-35	0.06-0.2	0.13-0.15	>7.8	4-8	Moderate	0.43	5	8	<.5
	6-24	35-55	<0.06	0.06-0.10	7.9-9.0	4-16	High	0.49			
	24-31	30-40	<0.06	0.06-0.12	7.9-9.0	8-16	Moderate	0.49			
	31-60	10-30	0.06-0.2	0.02-0.10	7.9-9.0	>8	Low	0.49			
140 Melga	0-4	12-27	0.2-0.6	0.13-0.17	5.6-7.8	<4	Low	0.55	5	8	<1
	4-18	27-35	<0.06	0.09-0.18	>8.4	4-16	Moderate	0.49			
	18-26	27-35	<0.06	0.03-0.05	>9.0	4-8	Low	0.37			
	26-60	10-30	0.06-0.6	0.11-0.15	>8.4	<8	Low	0.49			
141, 142, 143 Mercey	0-3	20-27	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.43	2	6	<.5
	3-25	20-30	0.2-0.6	0.15-0.18	7.9-8.4	<2	Moderate	0.43			
	25	---	---	---	---	---	---	---			
144 Milham	0-14	10-20	2.0-6.0	0.09-0.11	7.4-8.4	<2	Low	0.32	5	5	<1
	14-32	20-30	0.2-0.6	0.14-0.18	7.9-8.4	<2	Moderate	0.28			
	32-60	27-35	0.06-0.2	0.17-0.19	7.9-8.4	<2	Moderate	0.32			
145, 146 Millsholm	0-4	27-30	0.6-2.0	0.17-0.19	5.6-7.3	<2	Moderate	0.37	1	8	1-3
	4-17	27-30	0.6-2.0	0.17-0.19	5.6-7.3	<2	Moderate	0.37			
	17	---	---	---	---	---	---	---			
147 Nord	0-18	10-18	0.6-2.0	0.10-0.13	6.6-8.4	<2	Low	0.37	5	7	1-2
	18-72	10-18	0.6-2.0	0.11-0.15	7.4-8.4	<2	Low	0.43			
148 Nord	0-18	10-18	0.2-0.6	0.08-0.10	8.5-9.0	4-8	Low	0.37	5	7	1-2
	18-72	10-18	0.2-0.6	0.08-0.12	8.5-9.0	4-8	Low	0.43			
149*:											
Nord	0-18	10-18	0.6-2.0	0.10-0.13	6.6-8.4	<2	Low	0.37	5	7	1-2
	18-72	10-18	0.6-2.0	0.11-0.15	7.4-8.4	<2	Low	0.43			
Nord	0-18	10-18	0.2-0.6	0.08-0.10	8.5-9.0	4-8	Low	0.37	5	7	1-2
	18-72	10-18	0.2-0.6	0.08-0.12	8.5-9.0	4-8	Low	0.43			
150 Panoche	0-7	18-27	0.6-2.0	0.14-0.16	7.4-8.4	<2	Low	0.43	5	6	<.5
	7-60	18-35	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.43			

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
151------------- Panoche	0-7	27-35	0.2-0.6	0.11-0.16	7.9-9.0	4-8	Moderate	0.43	5	7	<.5
	7-60	18-35	0.2-0.6	0.05-0.14	8.5-9.0	4-16	Moderate	0.43			
152------------- Parkfield Variant	0-4	30-35	0.2-0.6	0.13-0.17	6.6-7.8	<2	Moderate	0.32	2	8	1-2
	4-35	35-50	0.06-0.2	0.14-0.16	7.4-8.4	<2	High------	0.28			
	35	---	---	---	---	---	----------	----			
153------------- Pitco	0-23	40-60	<0.06	0.02-0.12	6.6-9.0	>4	High------	0.37	5	8	1-2
	23-60	35-60	<0.06	0.02-0.12	7.4-9.0	>4	High------	0.37			
154*: Pits.											
Dumps.											
155------------- Rambla	0-15	2-10	2.0-6.0	0.05-0.08	7.9-8.4	<8	Low-------	0.24	5	2	<1
	15-19	2-10	2.0-6.0	0.05-0.09	7.9-9.0	<8	Low-------	0.43			
	19-45	40-60	<0.06	0.02-0.11	7.9-9.0	>8	High------	0.32			
	45-60	2-10	2.0-6.0	0.02-0.05	7.9-9.0	>8	Low-------	0.20			
156, 157--------- Reefridge	0-14	40-60	0.06-0.2	0.13-0.16	6.6-8.4	<4	High------	0.20	3	8	<1
	14-48	35-60	0.06-0.2	0.10-0.17	7.9-8.4	4-8	High------	0.20			
	48	---	---	---	---	---	----------	----			
158------------- Remnoy	0-5	8-15	0.2-0.6	0.08-0.12	>8.4	4-16	Low-------	0.55	1	6	<.5
	5-15	27-35	0.06-0.2	0.09-0.13	>8.4	8-16	Moderate	0.49			
	15-29	---	---	---	---	---	----------	----			
	29-70	7-15	0.2-0.6	0.08-0.11	>8.4	8-16	Low-------	0.55			
159*: Rock outcrop.											
Dystric Lithic Xerochrepts.											
160*: Rock outcrop.											
Lithic Torriorthents.											
161------------- Sagaser	0-6	17-20	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.32	3	8	2-4
	6-34	27-35	0.2-0.6	0.15-0.17	6.6-7.8	<2	Moderate	0.37			
	34-42	27-35	0.2-0.6	0.12-0.15	6.6-7.8	<2	Moderate	0.28			
	42	---	---	---	---	---	----------	----			
162------------- Sandridge	0-24	1-5	6.0-20	0.06-0.11	6.1-9.0	<2	Low-------	0.15	5	2	<.5
	24-60	1-5	0.6-2.0	0.05-0.10	>7.8	<4	Low-------	0.15			
163------------- Tulare	0-16	40-60	<0.06	0.12-0.13	7.9-8.4	2-8	High------	0.28	5	8	2-3
	16-60	40-60	<0.06	0.11-0.12	7.9-8.4	4-8	High------	0.28			
164------------- Tulare Variant	0-10	60-70	<0.06	0.02-0.10	7.4-8.4	>8	High------	0.28	5	8	1-2
	10-56	60-70	<0.06	0.02-0.10	7.4-8.4	>8	High------	0.28			
	56-60	10-20	0.6-2.0	0.02-0.10	7.4-8.4	>8	Low-------	0.32			
165------------- Twisselman	0-9	40-60	0.06-0.2	0.14-0.17	7.9-8.4	<2	High------	0.32	5	8	<.5
	9-60	35-60	0.06-0.2	0.12-0.17	7.9-8.4	<4	High------	0.32			
166------------- Twisselman	0-9	40-60	<0.06	0.03-0.12	7.9-9.0	>8	High------	0.32	5	8	<.5
	9-60	35-60	<0.06	0.03-0.08	7.9-9.0	>16	High------	0.32			
167*. Urban land											

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
168-------------- Vanguard	0-16	5-15	0.6-2.0	0.05-0.10	>7.8	>8	Low--------	0.37	5	5	1-2
	16-60	18-27	0.6-2.0	0.12-0.16	>7.8	4-8	Low--------	0.32			
169*, 170*:											
Vaquero---------	0-17	40-60	0.06-0.2	0.13-0.16	6.6-8.4	<2	High-------	0.20	2	8	<2
	17-36	40-60	0.06-0.2	0.09-0.17	7.9-9.0	<16	High-------	0.28			
	36	---	---	---	---	---	-----------	----			
Altamont--------	0-31	35-60	0.06-0.2	0.12-0.16	6.1-8.4	<2	High-------	0.24	3	8	1-3
	31-55	35-60	0.06-0.2	0.12-0.16	7.4-8.4	<2	High-------	0.24			
	55	---	---	---	---	---	-----------	----			
171*:											
Vaquero---------	0-17	40-60	0.06-0.2	0.13-0.16	6.6-8.4	<2	High-------	0.20	2	8	<2
	17-36	40-60	0.06-0.2	0.09-0.17	7.9-9.0	<16	High-------	0.28			
	36	---	---	---	---	---	-----------	----			
Altamont--------	0-31	35-60	0.06-0.2	0.12-0.16	6.1-8.4	<2	High-------	0.24	3	8	1-3
	31-55	35-60	0.06-0.2	0.12-0.16	7.4-8.4	<2	High-------	0.24			
	55	---	---	---	---	---	-----------	----			
Millsholm-------	0-4	27-30	0.6-2.0	0.17-0.19	5.6-7.3	<2	Moderate	0.37	1	8	1-3
	4-17	27-30	0.6-2.0	0.17-0.19	5.6-7.3	<2	Moderate	0.37			
	17	---	---	---	---	---	-----------	----			
172, 173--------- Wadespring	0-1	15-27	0.6-2.0	0.14-0.17	6.6-7.3	<2	Low--------	0.28	2	8	1-3
	1-18	27-35	0.6-2.0	0.16-0.19	7.4-8.4	<2	Moderate	0.28			
	18-31	27-35	0.6-2.0	0.15-0.18	7.4-8.4	<2	Moderate	0.24			
	31	---	---	---	---	---	-----------	----			
174-------------- Wasco	0-20	8-18	2.0-6.0	0.08-0.11	6.1-7.8	<2	Low--------	0.32	5	5	<.5
	20-60	8-18	2.0-6.0	0.08-0.13	6.6-8.4	<2	Low--------	0.32			
175-------------- Westcamp	0-10	10-27	0.2-2.0	0.06-0.16	>7.3	>2	Low--------	0.43	5	6	<1
	10-37	18-35	0.06-0.6	0.06-0.17	>7.8	>2	Low--------	0.49			
	37-72	35-55	<0.06	0.06-0.16	>7.8	>4	High-------	0.32			
176, 177--------- Westhaven	0-7	18-27	0.6-2.0	0.15-0.17	7.4-8.4	<2	Low--------	0.43	5	7	<2
	7-45	18-35	0.2-0.6	0.15-0.19	7.4-8.4	<2	Moderate	0.49			
	45-72	30-50	0.2-0.6	0.17-0.20	7.4-6.4	<2	High-------	0.43			
	72-84	5-15	2.0-6.0	0.07-0.12	7.4-8.4	<2	Low--------	0.20			
178-------------- Westhaven	0-10	27-40	0.06-0.2	0.14-0.19	7.9-9.0	4-8	Moderate	0.37	5	8	<1
	10-40	18-35	0.06-0.2	0.13-0.16	7.9-9.0	4-8	Moderate	0.43			
	40-60	30-50	0.06-0.2	0.13-0.16	7.9-9.0	4-8	High-------	0.43			
179-------------- Whitewolf	0-10	5-10	2.0-6.0	0.08-0.11	6.1-8.4	<2	Low--------	0.20	5	5	<1
	10-60	0-5	6.0-20	0.04-0.08	6.1-8.4	<2	Low--------	0.20			
180-------------- Youd	0-10	12-18	0.2-0.6	0.05-0.12	5.6-7.3	>8	Low--------	0.49	1	5	<.5
	10-26	---	---	---	---	---	-----------	----			
	26-60	7-20	0.2-2.0	0.08-0.15	6.6-8.4	<8	Low--------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In		In			
101 Armona	C	None	---	---	2.0-4.5	Perched	Jan-Dec	>60	---	---	---	High	High.
102 Avenal	B	None	---	---	>6.0	---	---	>60	---	---	---	High	High.
103 Boggs	C	None	---	---	3.0-4.0	Perched	Jan-Dec	>60	---	---	---	High	High.
104 Cajon	A	None	---	---	>6.0	---	---	>60	---	---	---	Moderate	Low.
105, 106 Cantua	B	None	---	---	>6.0	---	---	40-60	Soft	---	---	Moderate	Low.
107 Carollo	D	None	---	---	>6.0	---	---	20-40	Soft	---	---	High	High.
108 Corona	B	None	---	---	>6.0	---	---	>60	---	---	---	High	Low.
109, 110, 111 Delgado	D	None	---	---	>6.0	---	---	7-20	Hard	---	---	High	Low.
112 Excelsior	B	None	---	---	>6.0	---	---	>60	---	---	---	High	High.
113 Garces	D	None	---	---	>6.0	---	---	>60	---	---	---	High	Moderate.
114*:													
Gaviota	D	None	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate	Moderate.
Rock outcrop.													
115, 116 Gepford	D	Occasional	Very long	Jan-Mar	2.5-4.0	Perched	Jan-Dec	>60	---	---	---	High	High.
117 Goldberg	D	Rare	---	---	>6.0	---	---	>60	---	---	---	High	High.
118 Goldberg	D	Rare	---	---	3.0-6.0	Perched	Jan-Dec	>60	---	---	---	High	High.
119 Grangeville	C	Rare	---	---	3.0-4.0	Apparent	Jan-Dec	>60	---	---	---	High	Low.
120, 121 Grangeville	B	None	---	---	4.0-6.0	Apparent	Jan-Dec	>60	---	---	---	High	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In		In			
122, 123---------- Henneke	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	---	High------	Moderate.
124---------------- Homeland	C	Rare---------	---	---	2.0-4.0	Perched	Jul-Aug	>60	---	---	---	High------	High.
125---------------- Houser	D	Rare---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
126---------------- Houser	D	Rare---------	---	---	4.0-6.0	Perched	Jul-Aug	>60	---	---	---	High------	High.
127, 128---------- Kettleman	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	Low.
129*:													
Kettleman---------	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	Low.
Cantua------------	B	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	Moderate	Low.
130---------------- Kimberlina	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
131---------------- Kimberlina	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Low.
132*:													
Kimberlina--------	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
Garces------------	D	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Moderate.
133---------------- Kreyenhagen	B	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	High------	Low.
134---------------- Lakeside	B	None---------	---	---	4.0-6.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
135---------------- Lakeside	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
136---------------- Lakeside	B	None---------	---	---	4.0-6.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
137---------------- Lemoore	C	None---------	---	---	3.0-6.0	Perched	Jul-Aug	>60	---	---	---	High------	High.
138, 139---------- Lethent	D	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
140---------------- Melga	D	Occasional	Brief------	Feb-Apr	>6.0	---	---	>60	---	10-20	Thin	High------	High.
141, 142, 143----- Mercey	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hard-ness	Cemented pan: Depth	Cemented pan: Hard-ness	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In		In			
144----------------- Milham	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
145, 146---------- Millsholm	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate	Moderate.
147----------------- Nord	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
148----------------- Nord	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	High.
149*:													
Nord-------------	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
Nord-------------	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	High.
150----------------- Panoche	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	Low.
151----------------- Panoche	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	Moderate.
152----------------- Parkfield Variant	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High-----	Low.
153----------------- Pitco	D	None---------	---	---	4.0-5.0	Perched	Jan-Dec	>60	---	---	---	High-----	High.
154*:													
Pits.													
Dumps.													
155----------------- Rambla	C	None---------	---	---	>6.0	---	---	>60	---	---	---	High-----	High.
156, 157---------- Reefridge	D	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	High-----	High.
158----------------- Remnoy	D	Rare---------	---	---	>6.0	---	---	>60	---	10-20	Thick	High-----	High.
159*:													
Rock outcrop.													
Dystric Lithic Xerochrepts.													
160*:													
Rock outcrop.													
Lithic Torriorthents.													

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In		In			
161-------------- Sagaser	B	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	Moderate	Low.
162-------------- Sandridge	A	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Low.
163-------------- Tulare	D	Occasional	Very long	Jan-Mar	4.0-6.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
164-------------- Tulare Variant	D	None---------	---	---	3.0-4.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
165-------------- Twisselman	C	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Moderate.
166-------------- Twisselman	D	Rare---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
167*. Urban land													
168-------------- Vanguard	C	Rare---------	---	---	2.0-3.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
169*, 170*:													
Vaquero----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	High.
Altamont---------	D	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	High------	Low.
171*:													
Vaquero----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	High.
Altamont---------	D	None---------	---	---	>6.0	---	---	40-60	Soft	---	---	High------	Low.
Millsholm--------	D	None---------	---	---	>6.0	---	---	10-20	Hard	---	---	Moderate	Moderate.
172, 173---------- Wadespring	C	None---------	---	---	>6.0	---	---	20-40	Soft	---	---	High------	Low.
174-------------- Wasco	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Low.
175-------------- Westcamp	C	Rare---------	---	---	4.0-6.0	Perched	Jan-Dec	>60	---	---	---	High------	High.
176, 177---------- Westhaven	B	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Moderate.
178-------------- Westhaven	C	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	High.
179-------------- Whitewolf	A	None---------	---	---	>6.0	---	---	>60	---	---	---	High------	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In		In			
180--------------- Youd	D	Rare---------	---	---	>6.0	---	---	>60	---	8-20	Thick	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Altamont	Fine, montmorillonitic, thermic Typic Chromoxererts
Armona	Fine-loamy, mixed (calcareous), thermic Fluvaquentic Haplaquolls
Avenal	Fine-loamy, mixed, thermic Typic Haplargids
Boggs	Coarse-loamy, mixed, thermic Typic Salorthids
*Cajon	Mixed, thermic Typic Torripsamments
Cantua	Coarse-loamy, mixed, nonacid, thermic Typic Torriorthents
Carollo	Fine, montmorillonitic, thermic Typic Natrargids
Corona	Fine-loamy, mixed, thermic Pachic Argixerolls
Dystric Xerochrepts	Dystric Lithic Xerochrepts
Delgado	Loamy, mixed (calcareous), thermic Lithic Torriorthents
Excelsior	Coarse-loamy, mixed (calcareous), thermic Typic Torrifluvents
Garces	Fine-loamy, mixed, thermic Typic Natrargids
Gaviota	Loamy, mixed, nonacid, thermic Lithic Xerorthents
Gepford	Fine, montmorillonitic, thermic Vertic Haplaquolls
Goldberg	Fine, montmorillonitic, thermic Typic Natraquolls
Grangeville	Coarse-loamy, mixed, thermic Fluvaquentic Haploxerolls
*Henneke	Clayey-skeletal, serpentinitic, thermic Lithic Argixerolls
Homeland	Sandy, mixed, thermic Aeric Fluvaquents
Houser	Fine, montmorillonitic (calcareous), thermic Vertic Fluvaquents
Kettleman	Fine-loamy, mixed (calcareous), thermic Typic Torriorthents
Kimberlina	Coarse-loamy, mixed (calcareous), thermic Typic Torriorthents
Kreyenhagen	Fine-silty, mixed, thermic Typic Haploxeralfs
Lakeside	Fine-loamy, mixed, thermic Fluvaquentic Haploxerolls
Lemoore	Coarse-loamy, mixed (calcareous), thermic Aeric Haplaquents
Lethent	Fine, montmorillonitic, thermic Typic Natrargids
Lithic Torriothents	Lithic Torriorthents
Melga	Fine-silty, mixed, thermic Duric Natrargids
Mercey	Fine-silty, mixed, thermic Typic Camborthids
*Milham	Fine-loamy, mixed, thermic Typic Haplargids
Millsholm	Loamy, mixed, thermic Lithic Xerochrepts
Nord	Coarse-loamy, mixed, thermic Cumulic Haploxerolls
Panoche	Fine-loamy, mixed (calcareous), thermic Typic Torriorthents
Parkfield Variant	Fine, montmorillonitic, thermic Vertic Argixerolls
Pitco	Fine, montmorillonitic, thermic Fluvaquentic Haplaquolls
Rambla	Sandy over clayey, mixed (calcareous), thermic Typic Fluvaquents
Reefridge	Fine, montmorillonitic, thermic Typic Torrerts
Remnoy	Loamy, mixed, thermic, shallow Typic Nadurargids
Sagaser	Fine-loamy, mixed, thermic Typic Argixerolls
Sandridge	Siliceous, thermic Typic Torripsamments
Tulare	Fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls
Tulare Variant	Very fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls
Twisselman	Fine, mixed (calcareous), thermic Typic Torriorthents
Vanguard	Coarse-loamy, mixed (calcareous), thermic Typic Halaquepts
Vaquero	Fine, montmorillonitic, thermic Entic Chromoxererts
Wadesprings	Fine-loamy, serpentinitic, thermic Pachic Argixerolls
Wasco	Coarse-loamy, mixed, nonacid, thermic Typic Torriorthents
Westcamp	Fine-silty, mixed (calcareous), thermic Aeric Fluvaquents
Westhaven	Fine-silty, mixed (calcareous), thermic Typic Torrifluvents
Whitewolf	Mixed, thermic Xeric Torripsamments
Youd	Loamy, mixed, thermic, shallow Entic Durorthids

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LEGEND

SOILS ON THE DIABLO RANGE

1 — Henneke-Wadesprings-Millsholm: Shallow and moderately deep, moderately sloping to very steep, well drained soils that formed in residuum derived mainly from serpentine and sedimentary rock; on hills and mountains

2 — Gaviota-Vaquero-Altamont: Shallow to deep, moderately steep to very steep, well drained soils that formed in residuum derived from sedimentary rock; on hills and mountains

SOILS MAINLY ON THE KETTLEMAN AND KREYENHAGEN HILLS

3 — Delgado-Kettleman: Shallow and moderately deep, well drained and somewhat excessively drained, moderately sloping to steep soils that formed in residuum derived from sedimentary rock; on hills

4 — Kettleman-Cantua-Mercey: Moderately deep and deep, moderately well drained and somewhat excessively drained, sloping to steep soils that formed in residuum derived from sedimentary rock; on hills

5 — Delgado-Carollo: Shallow and moderately deep, moderately sloping to moderately steep, well drained and somewhat excessively drained soils that formed in residuum derived from sedimentary rock; on hills

SOILS ON ALLUVIAL FANS ON THE WESTERN SIDE OF THE SAN JOAQUIN VALLEY

6 — Avenal-Panoche: Very deep, nearly level to gently sloping, well drained soils that have a loam surface layer and formed in alluvium derived from sedimentary rock; on alluvial fans

7 — Panoche-Wasco: Very deep, nearly level to gently sloping, well drained soils that have a loam or sandy loam surface layer and formed in alluvium derived from sedimentary rock; on alluvial fans

8 — Wasco-Panoche-Westhaven: Very deep, nearly level to gently sloping, well drained and moderately well drained soils that have a loam or sandy loam surface layer and formed in alluvium derived from sedimentary rock; on alluvial fans

SALINE-ALKALI SOILS ON LOWER ALLUVIAL FANS AND BASIN RIMS IN THE SAN JOAQUIN VALLEY

9 — Lethent: Very deep, nearly level, moderately well drained soils that have a clay loam surface layer and formed in alluvium derived from sedimentary rock; on lower alluvial fans and basin rims

10 — Lethent-Garces-Panoche: Very deep, nearly level, well drained and moderately well drained soils that have a loam or clay loam surface layer and formed in alluvium derived from sedimentary and igneous rock; on lower alluvial fans and basin rims

11 — Lethent-Excelsior: Very deep, nearly level, well drained and moderately drained soils that have a fine sandy loam or sandy loam surface layer and formed in alluvium derived from igneous and sedimentary rock; on lower alluvial fans and basin rims

SALINE-ALKALI SOILS THAT HAVE A PERCHED WATER TABLE AND ARE IN BASINS AND ON LOW ALLUVIAL FANS, ALLUVIAL PLAINS, FLOOD PLAINS, AND BASIN RIMS

12 — Gepford-Westcamp-Houser: Very deep, nearly level, somewhat poorly drained and poorly drained soils that formed in alluvium derived from igneous and sedimentary rock; in basins and on flood plains and basin rims

13 — Tulare: Very deep, nearly level, somewhat poorly drained soils that formed in alluvium derived from igneous and sedimentary rock; in the Tulare Lake basin

14 — Armona-Lakeside-Grangeville: Very deep, nearly level, somewhat poorly drained and poorly drained soils that formed in alluvium derived dominantly from igneous and sedimentary rock; on basin rims, flood plains, alluvial plains, and alluvial fans

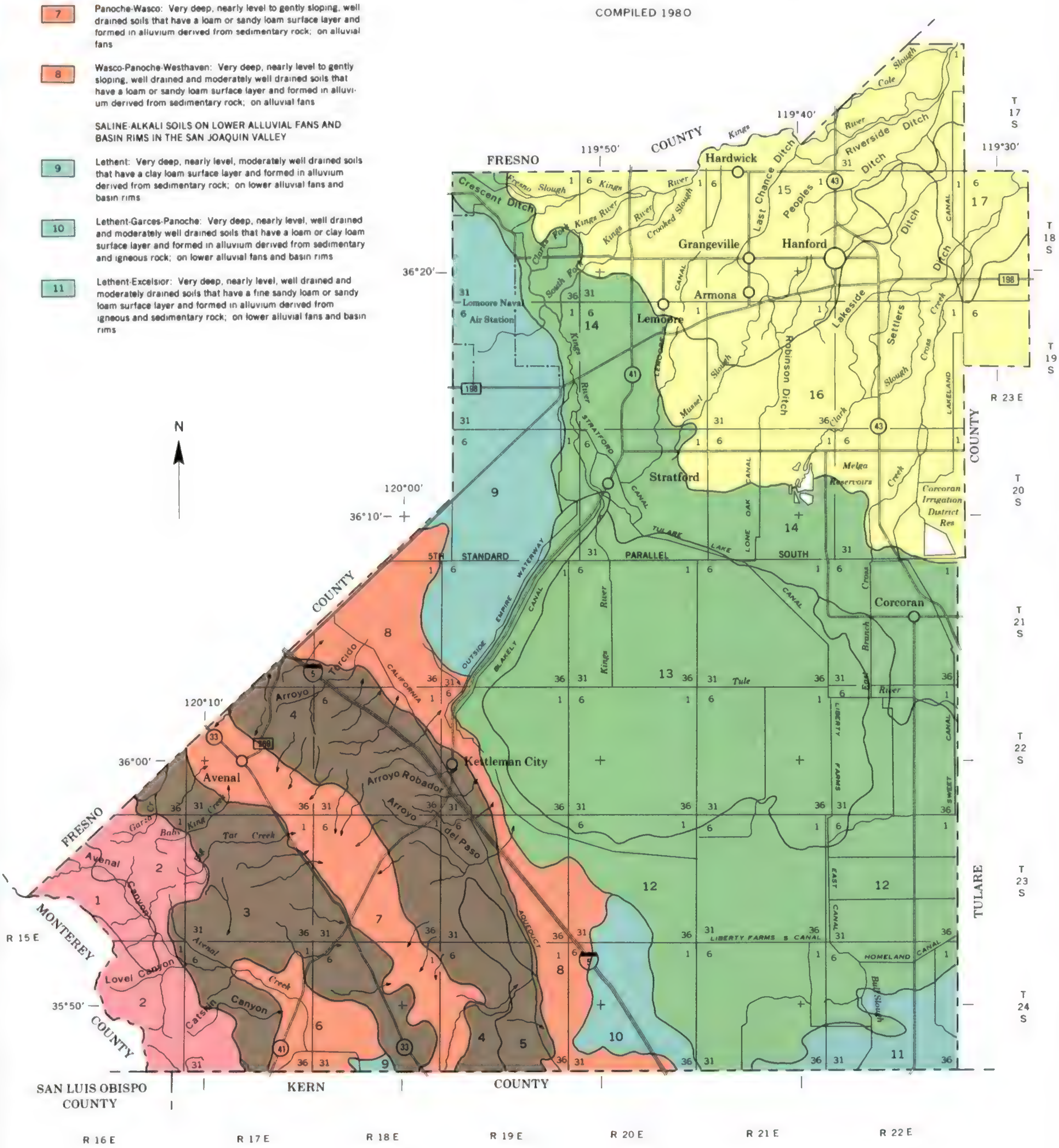
SOIL ON ALLUVIAL FANS AND FLOOD PLAINS IN THE MIDDLE OF SAN JOAQUIN VALLEY

15 — Nord: Very deep, nearly level, well drained soils that formed in alluvium derived from igneous and sedimentary rock; on alluvial fans

16 — Kimberlina-Garces: Very deep, nearly level, well drained, saline-alkali soils that formed in alluvium derived dominantly from igneous and sedimentary rock; on alluvial fans

17 — Remnoy-Melga-Youd: Shallow and very deep, nearly level, somewhat poorly drained, saline-alkali soils that formed in alluvium derived from igneous and sedimentary rock; on flood plains and alluvial fans

COMPILED 1980



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
KINGS COUNTY, CALIFORNIA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

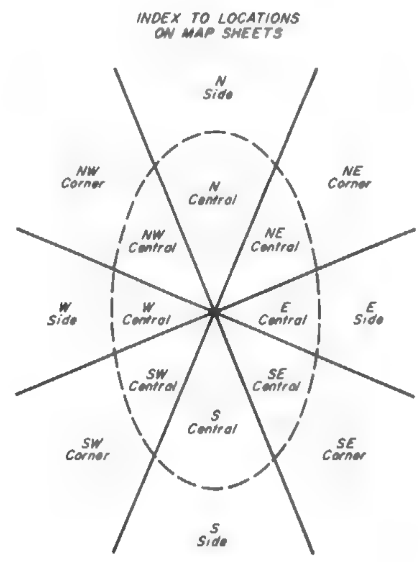
SECTIONALIZED TOWNSHIP

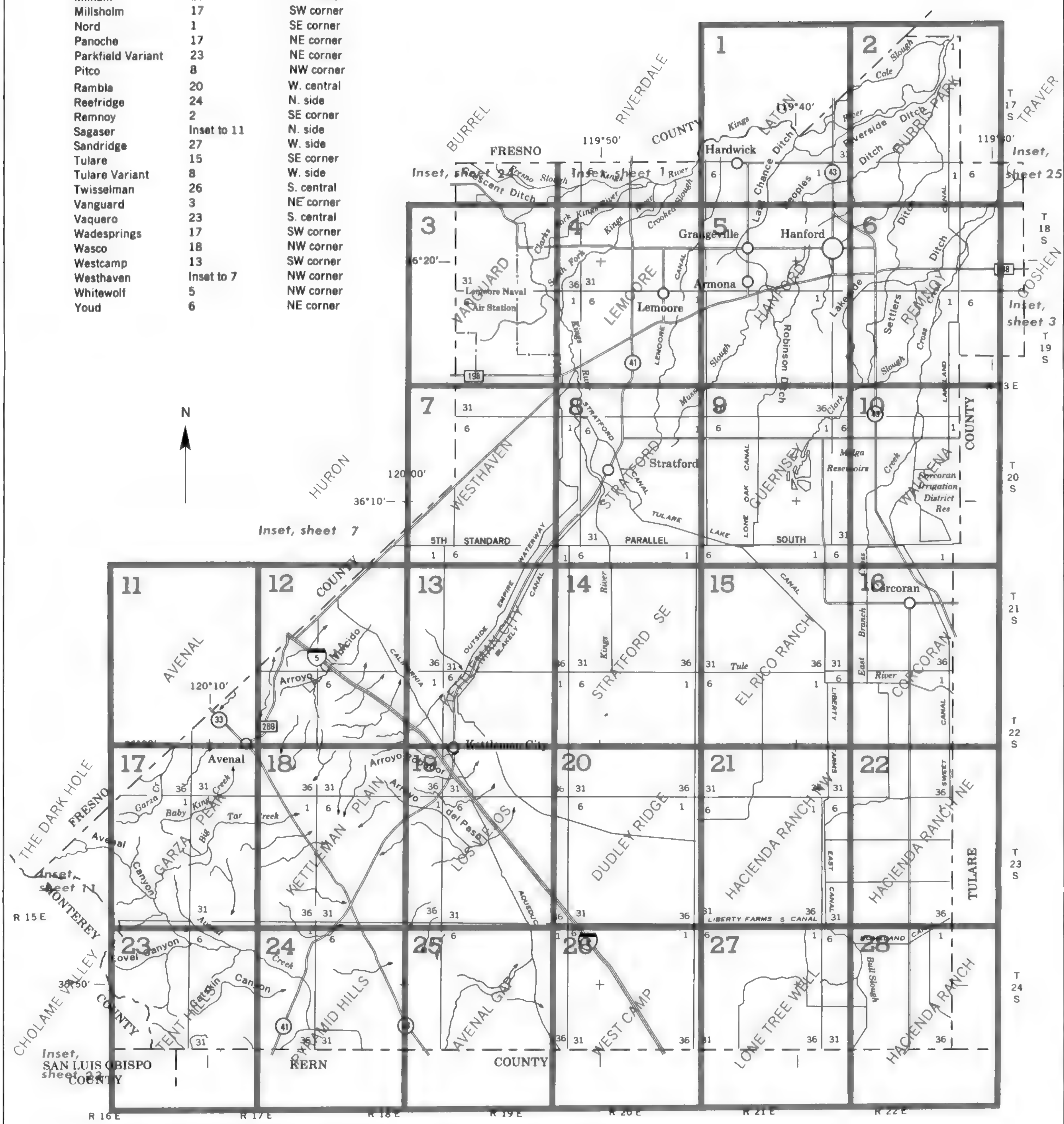
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL SITES FOR KINGS COUNTY

NAME OF SERIES	SHEET NO.	PART OF SHEET
Altamont	17	SW corner
Armona	8	SW central
Avenal	24	NW corner
Boggs	4	S. side
Cajon	5	E. side
Cantua	18	SE corner
Carollo	25	E. side
Corona	2	SW corner
Delgado	24	N. side
Excelsior	6	SW corner
Garces	10	N. side
Gaviota	23	NW central
Gepford	3	NE corner
Goldberg	4	S. central
Grangeville	8	N. side
Henneke	Inset to 11	E. central
Homeland	20	E. side
Houser	20	W. central
Kettleman	18	NW corner
Kimberlina	5	NE corner
Kreyenhagen	17	W. side
Lakeside	8	N. side
Lemoore	4	S. side
Lethent	3	SE corner
Melga	6	NE corner
Mercey	24	N. side
Milham	20	SW corner
Millsholm	17	SW corner
Nord	1	SE corner
Panoche	17	NE corner
Parkfield Variant	23	NE corner
Pitco	8	NW corner
Rambla	20	W. central
Reefridge	24	N. side
Remnoy	2	SE corner
Sagaser	Inset to 11	N. side
Sandridge	27	W. side
Tulare	15	SE corner
Tulare Variant	8	W. side
Twisselman	26	S. central
Vanguard	3	NE corner
Vaquero	23	S. central
Wadesprings	17	SW corner
Wasco	18	NW corner
Westcamp	13	SW corner
Westhaven	Inset to 7	NW corner
Whitewolf	5	NW corner
Youd	6	NE corner





SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS
KINGS COUNTY, CALIFORNIA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

SOIL LEGEND

SYMBOL	NAME
101	Armona loam, partially drained
102	Avenal loam, 0 to 5 percent slopes
103	Boggs sandy loam, partially drained
104	Cajon sandy loam
105	Cantua coarse sandy loam, 5 to 15 percent slopes
106	Cantua coarse sandy loam, 15 to 30 percent slopes
107	Carollo clay loam, 5 to 20 percent slopes
108	Corona silt loam
109	Delgado sandy loam, 5 to 15 percent slopes
110	Delgado sandy loam, 15 to 30 percent slopes
111	Delgado gravelly sandy loam, 15 to 30 percent slopes
112	Excelsior sandy loam
113	Garces loam
114	Gaviota-Rock outcrop complex, 50 to 75 percent slopes
115	Gepford clay, partially drained
116	Gepford clay, sandy substratum, partially drained
117	Goldberg loam, drained
118	Goldberg loam, partially drained
119	Grangeville sandy loam, saline-alkali
120	Grangeville fine sandy loam, partially drained
121	Grangeville fine sandy loam, saline-alkali, partially drained
122	Henneke very gravelly clay loam, 5 to 15 percent slopes
123	Henneke very gravelly clay loam, 15 to 50 percent slopes
124	Homeland fine sandy loam, partially drained
125	Houser fine sandy loam, drained
126	Houser clay, partially drained
127	Kettleman loam, 5 to 15 percent slopes
128	Kettleman loam, 15 to 30 percent slopes
129	Kettleman-Cantua complex, 30 to 50 percent slopes
130	Kimberlina fine sandy loam, saline-alkali
131	Kimberlina fine sandy loam, sandy substratum
132	Kimberlina-saline alkali-Garces complex
133	Kreyenhagen loam, 50 to 75 percent slopes
134	Lakeside loam, partially drained
135	Lakeside clay loam, drained
136	Lakeside clay, partially drained
137	Lemoore sandy loam, partially drained
138	Lethent fine sandy loam
139	Lethent clay loam
140	Melga silt loam
141	Mercey loam, 5 to 15 percent slopes
142	Mercey loam, 15 to 30 percent slopes
143	Mercey loam, 30 to 50 percent slopes
144	Milham sandy loam, silty substratum
145	Millsholm clay loam, 15 to 50 percent slopes
146	Millsholm clay loam, 50 to 75 percent slopes
147	Nord fine sandy loam
148	Nord fine sandy loam, saline-alkali
149	Nord complex
150	Panoche loam
151	Panoche clay loam, saline-alkali
152	Parkfield Variant gravelly clay loam, 2 to 8 percent slopes
153	Pitco clay, partially drained
154	Pits and Dumps
155	Rambla loamy sand, drained
156	Reefridge clay, 5 to 15 percent slopes
157	Reefridge clay, 15 to 30 percent slopes
158	Remnoy very fine sandy loam
159	Rock outcrop-Dystric Lithic Xerochrepts complex, 30 to 100 percent slopes
160	Rock outcrop-Lithic Torriorthents complex, 15 to 75 percent slopes
161	Sagaser loam, 50 to 75 percent slopes
162	Sandridge loamy fine sand
163	Tulare clay, partially drained
164	Tulare Variant clay, partially drained
165	Twisselman silty clay
166	Twisselman silty clay, saline-alkali
167	Urban land
168	Vanguard sandy loam, partially drained
169	Vaquero and Altamont clays, 15 to 50 percent slopes
170	Vaquero and Altamont clays, 50 to 75 percent slopes
171	Vaquero-Altamont-Millsholm complex, 15 to 50 percent slopes
172	Wadesprings stony loam, 15 to 50 percent slopes
173	Wadesprings stony loam, 50 to 75 percent slopes
174	Wasco sandy loam, 0 to 5 percent slopes
175	Westcamp loam, partially drained
176	Westhaven loam, 0 to 2 percent slopes
177	Westhaven loam, 2 to 5 percent slopes
178	Westhaven clay loam, saline-alkali, 0 to 2 percent slopes
179	Whitewolf coarse sandy loam
180	Youd fine sandy loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Haden Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CnB, WaC2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

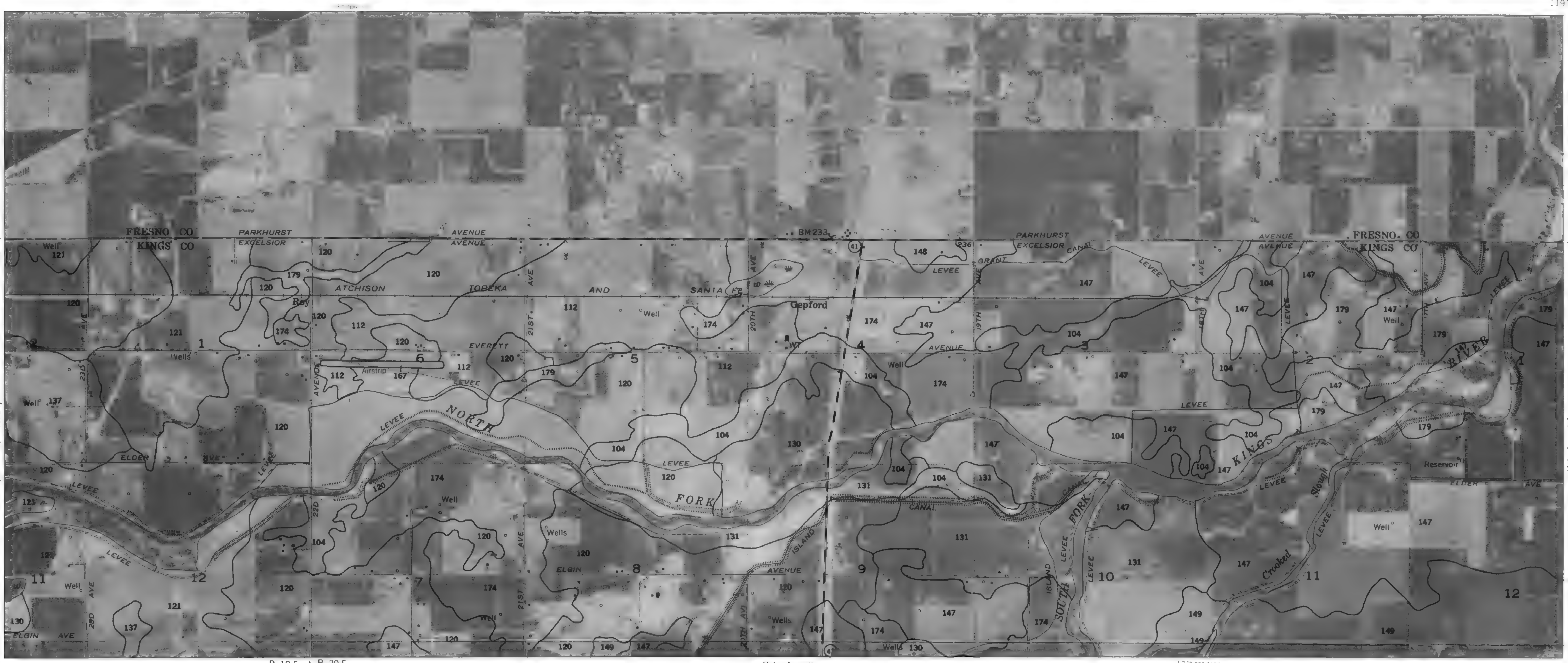
GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot



119°52'30"
36°22'30"
R. 19 E. | R. 20 E.
(Joins sheet 4)
(Joins inset, sheet 24)
(Joins lower left)

R. 20 E. | R. 21 E.
R. 21 E. | R. 22 E.
119°47'30"
36°22'30"
119°45'
(Joins sheet 5)
(Joins upper right)
(Joins sheet 2)

2 MILES
2 KILOMETERS
SCALE 1:24000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1972 and 1976 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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SCALE 1:24000

1 MILES 1/2 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
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1 1/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

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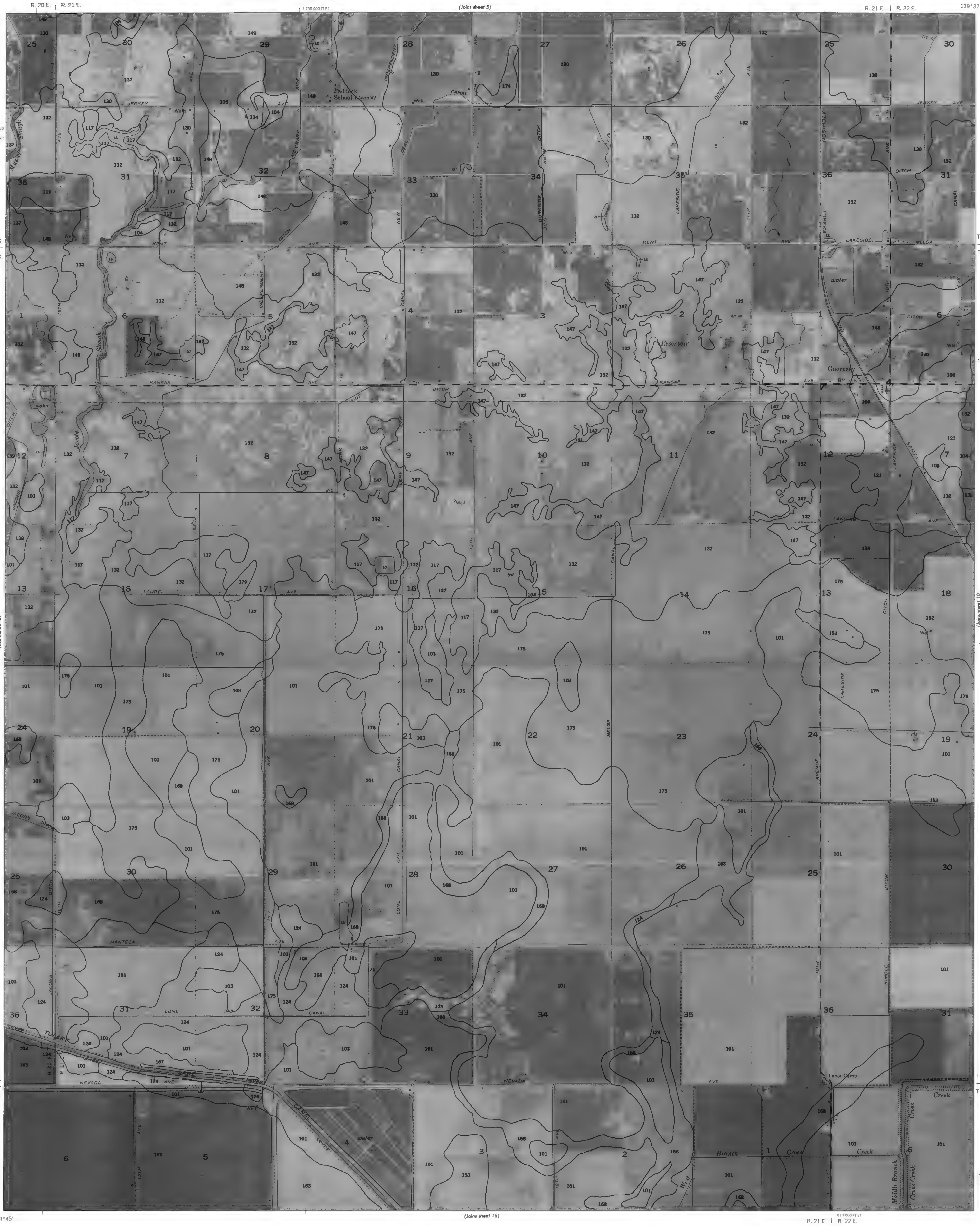
1 MILES 0 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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2 MILES
1 0.5 0 1 2 KILOMETERS
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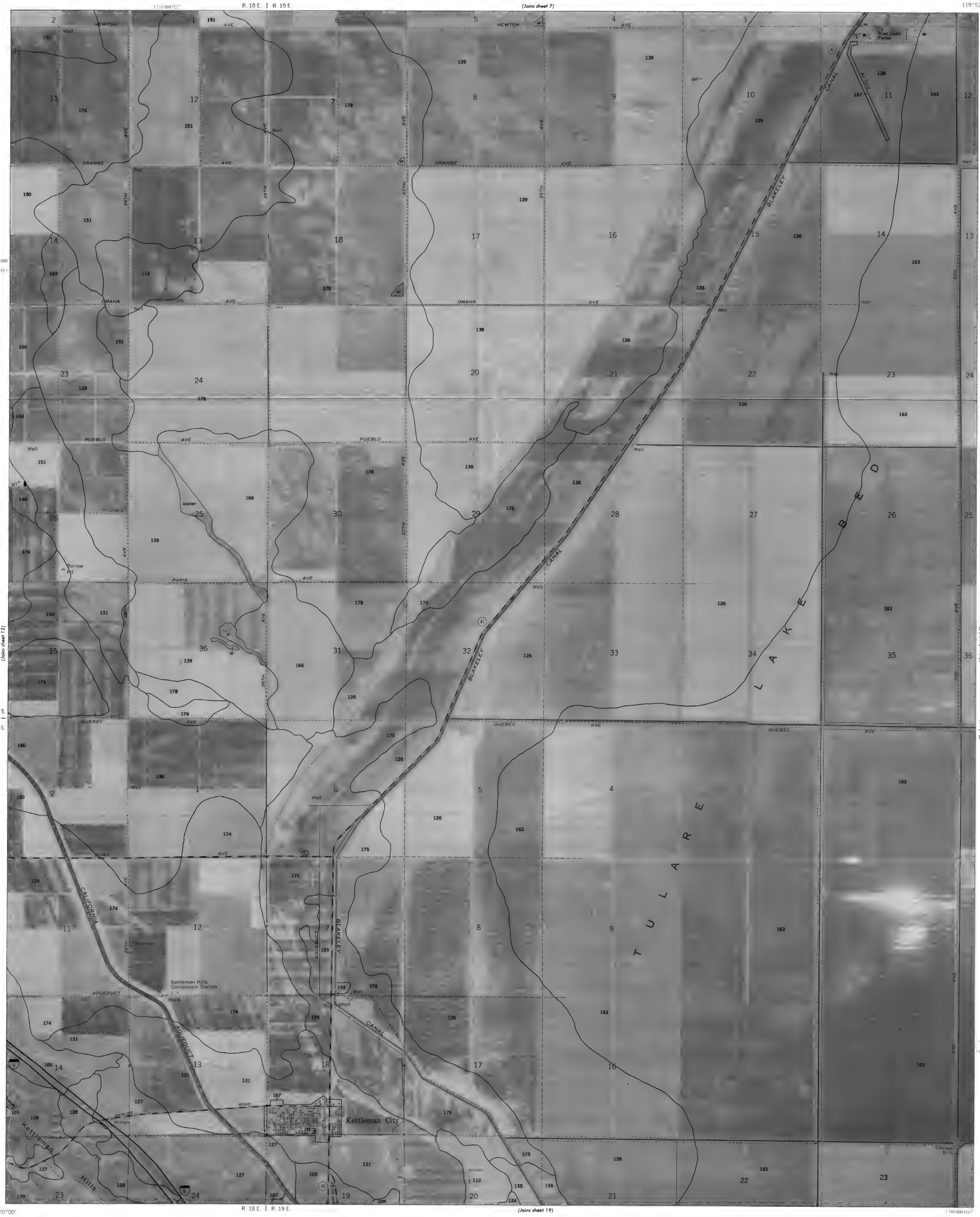
1 1/2 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 13
SOIL SURVEY OF KINGS COUNTY, CALIFORNIA
(KETTLEMAN CITY QUADRANGLE)



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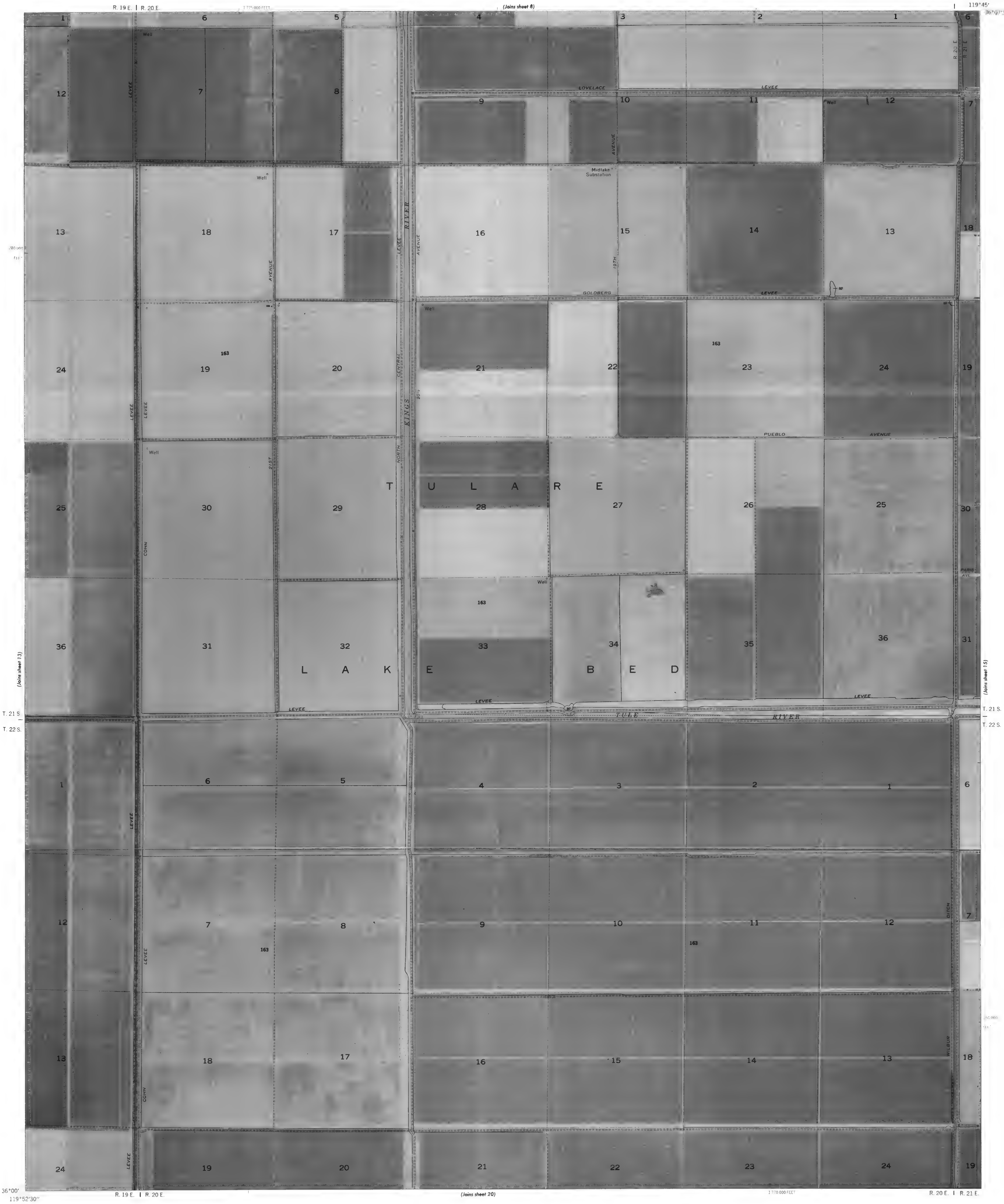

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1/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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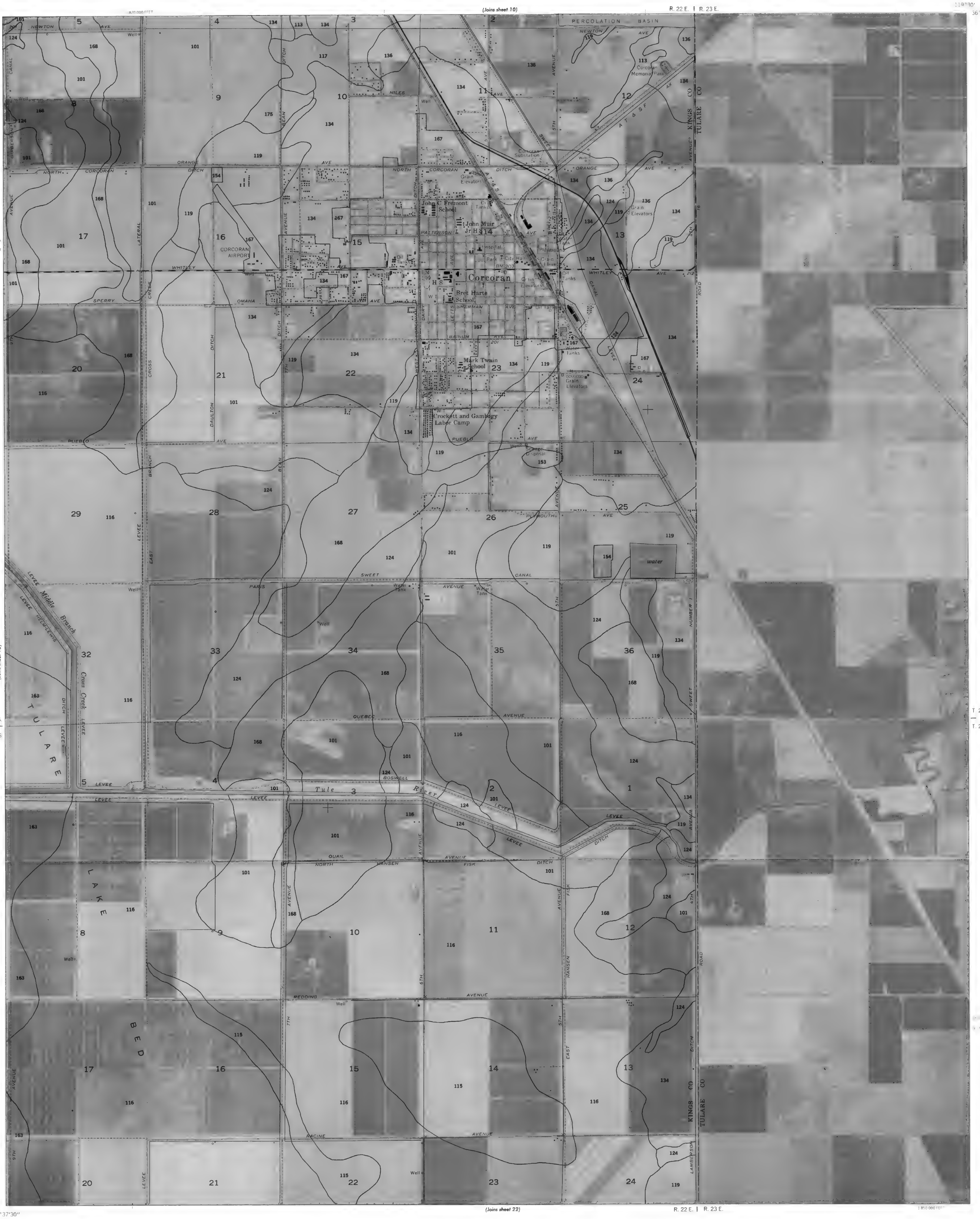

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

R. 17 E. | R. 18 E. (Joins sheet 12)

R. 17 E. | R. 18 E. (Joins sheet 24)

SCALE 1:24000

1 MILES

2 KILOMETERS

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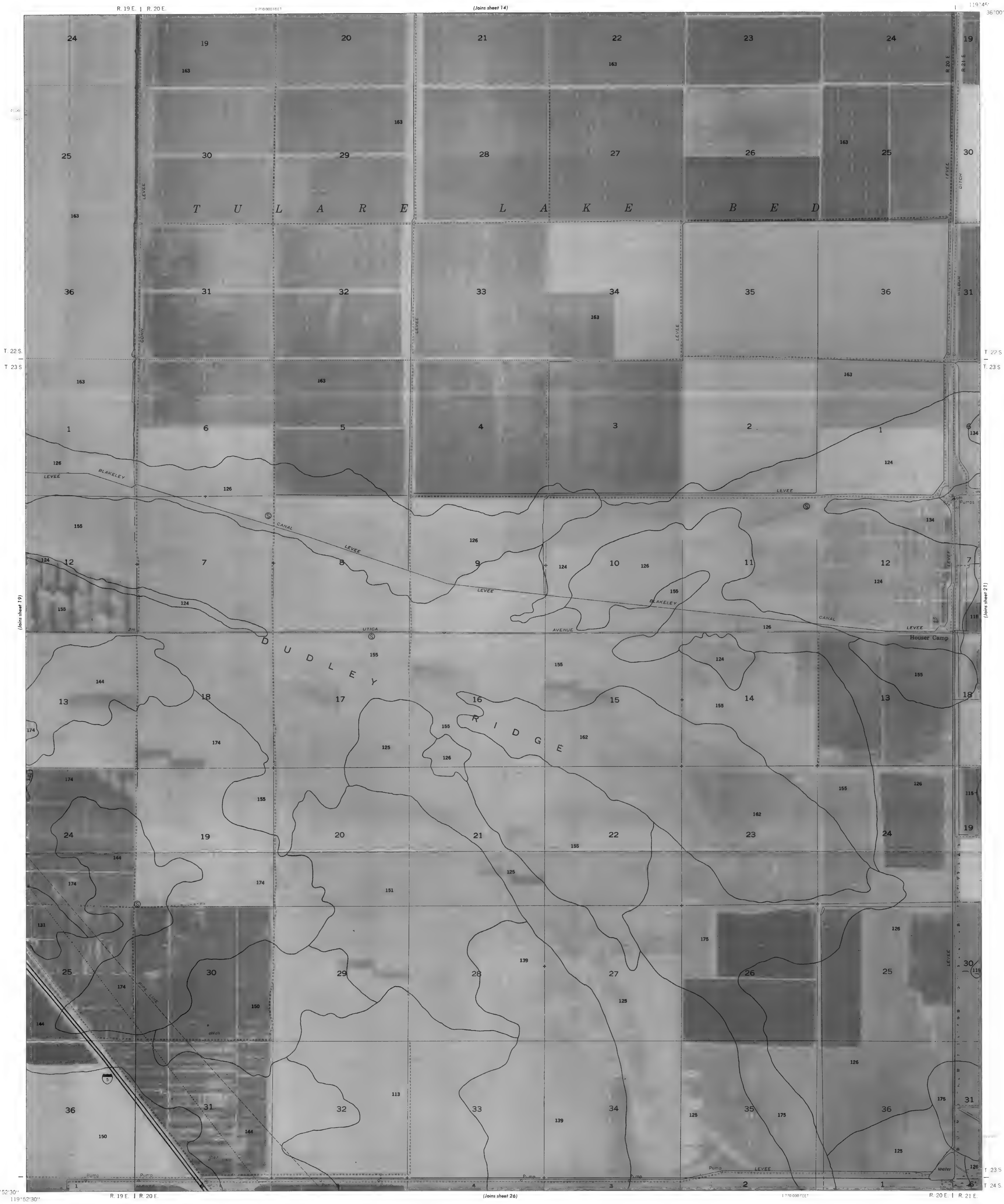
SCALE 1:24000 — 2 MILES — 2 KILOMETERS



1 3/4 1/2 1/4 0 1 2 MILES
0.5 0 1 2 KILOMETERS
SCALE 1:24000

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1 ½ 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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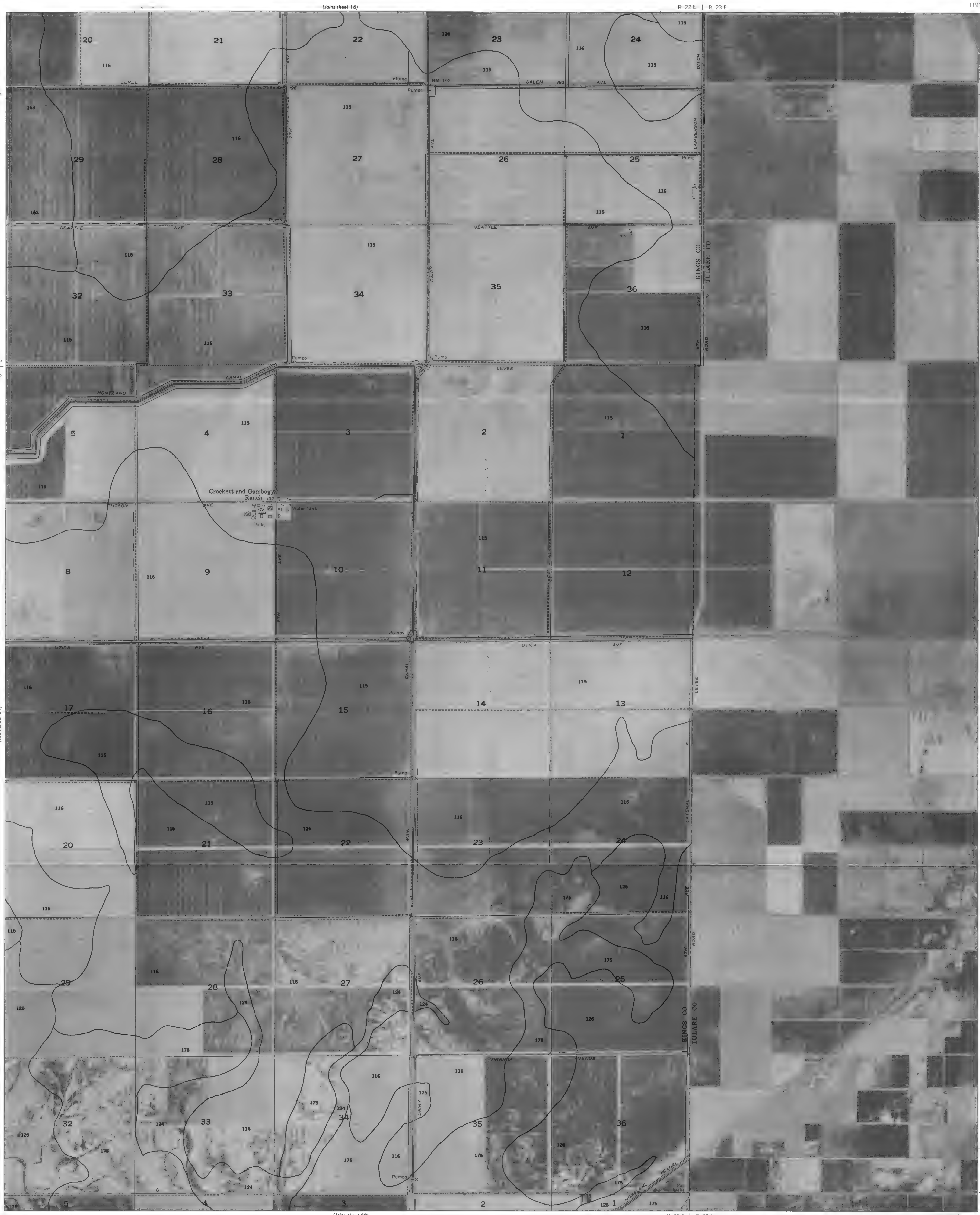

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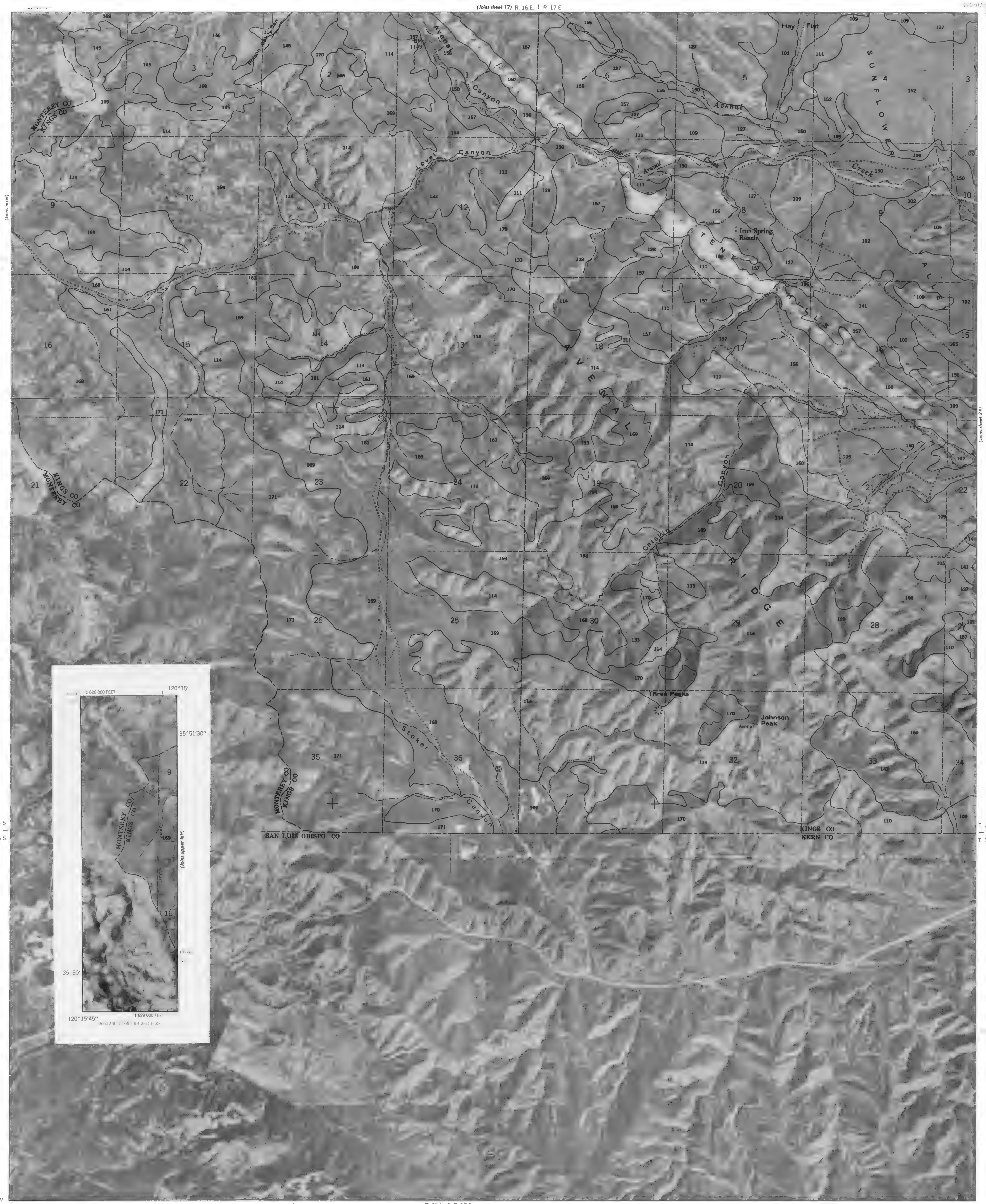
SCALE 1:24000

MILES

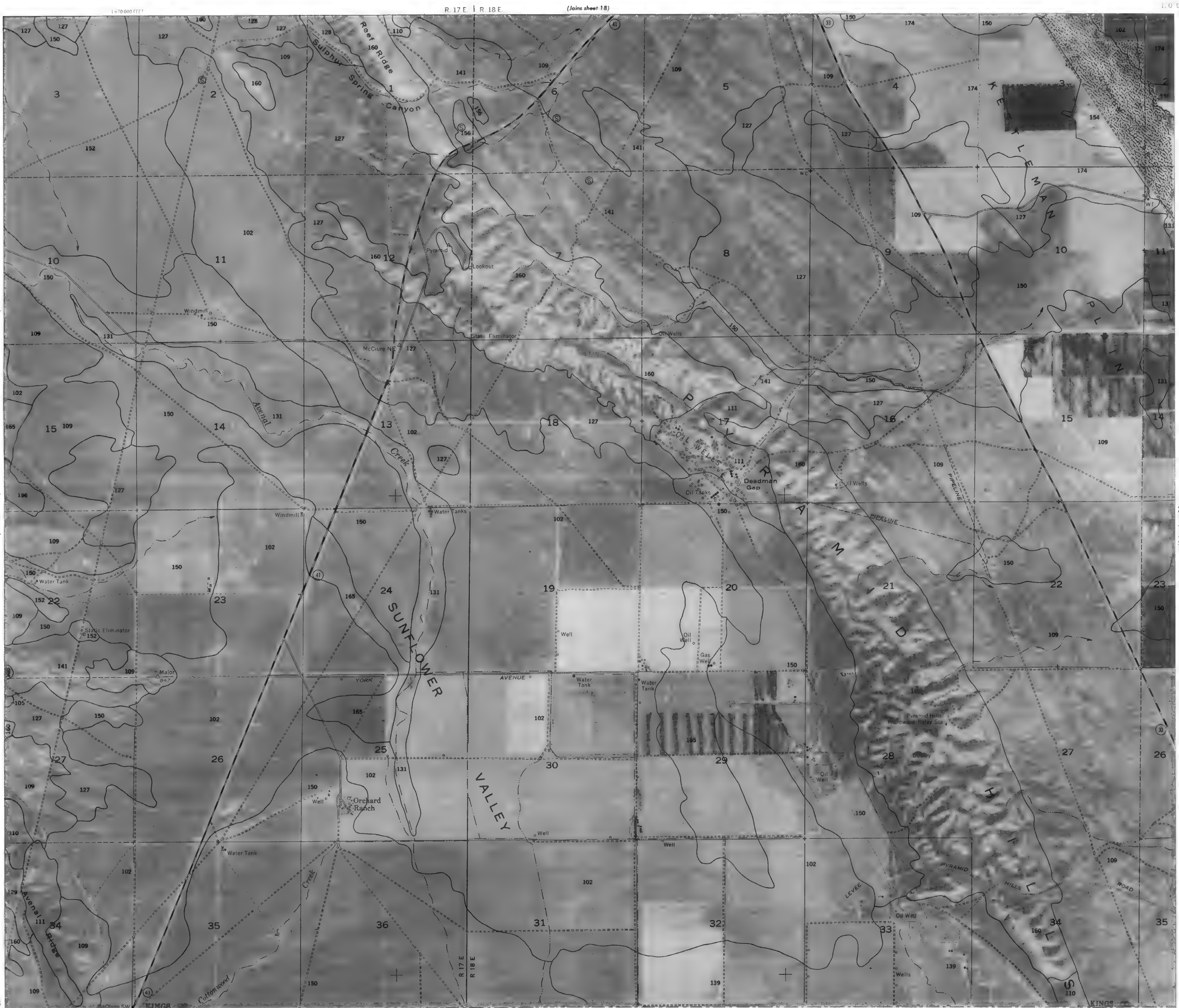
KILOMETERS



SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 24
SOIL SURVEY OF KINGS COUNTY, CALIFORNIA
(PYRAMID HILLS AND PART OF BURREL QUADRANGLES)



35°45'
120°07'30"
R. 17 E. | R. 18 E.

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2 MILES
2 KILOMETERS
SCALE 1:24000

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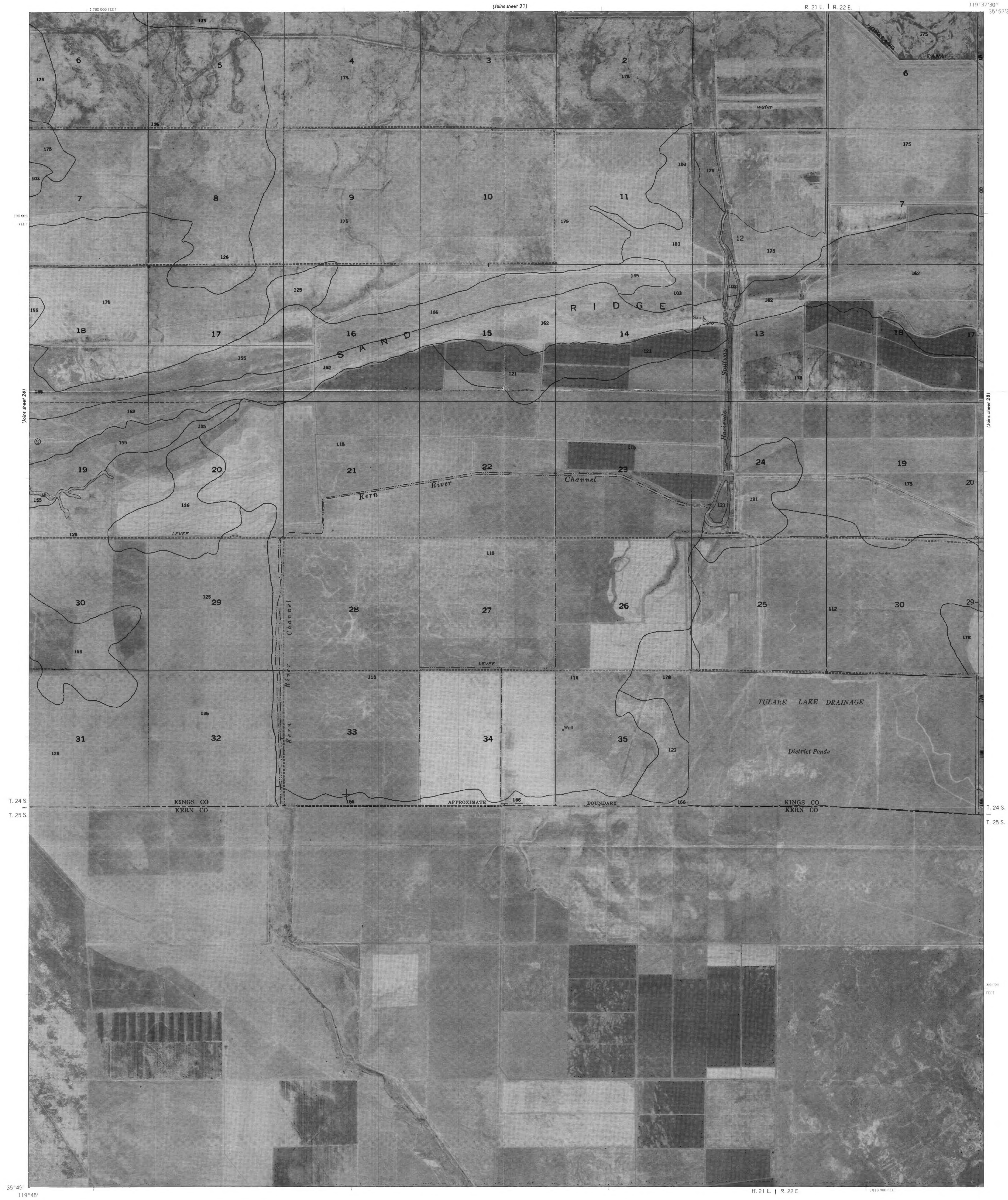
SCALE 1:24000



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SURVEY OF KINGS COUNTY, CALIFORNIA
(HACIENDA RANCH QUADRANGLE)

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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KINGS COUNTY, CALIFORNIA NO. 28